Centre for the Study of Living Standards

111 Sparks Street, Suite 500
Ottawa, Ontario K1P 5B5
613-233-8891 Fax 613-233-8250
csls@csls.ca

Productivity: Key to Economic Success

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Productivity: Key to Economic Success

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Productivity: Key to Economic Success

Executive Summary

This report provides a comprehensive overview of the productivity issue. It reviews productivity concepts and trends, examines the determinants of productivity growth in the Canadian context, discusses key issues in the productivity literature, and outlines certain private sector actions and public policies to improve productivity.

The main messages of the report are highlighted below.

- Productivity performance is the key to improving the country's living standards. From this perspective, productivity improvement should not only be the goal of the business community, but of all groups in society.

- Since 1973, Canada's productivity growth has fallen off substantially. The key explanation of this slowdown is the ebbing of the impact of the historically unprecedented factors that came together to boost productivity growth in the immediate postwar period (e.g. shift of the workforce out of low productivity agriculture, increased international trade, rapid capital accumulation and introduction of new technologies postponed during the Great Depression and World War II).

- The further deterioration of productivity growth in the 1990s is explained by the poor macroeconomic environment as economic growth below potential or trend results in productivity growth below potential or trend.

- Canada's productivity levels have fallen relative to other industrial countries in recent years, reflecting faster productivity growth in these countries. This situation is due to the inevitable catch-up of these countries to the technological leader, the United States (Canada was already close to the US) and to an inability on the part of the Canadian economy to maximize its potential productivity growth.

- There is a three-way complementarity between physical capital, human capital, and technological progress. Therefore, the best approach to improve our productivity performance is a three-pronged approach that focuses on capital accumulation and investment, human capital development, and technological innovation.

Some of the main findings and conclusions of the report are outlined below.

- The only sustained manner in the long run to increase per capita income is by increasing the amount of output produced per worker, that is by raising labour productivity. From this perspective, productivity represents the key to economic

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success. Economists of all leanings accept this basic relationship between productivity and living standards. Indeed, it is one of the few relationships economists agree on.

- Productivity is the relationship between output of goods and services and the inputs of resources, human and non-human used in the production process, with the relationship usually expressed in ratio form. Both outputs and inputs are measured in physical volumes and thus are unaffected by price changes. Constant prices as of one period are used to add up the units of different outputs and inputs in order to combine them into aggregate measures. The ratios may relate to the national economy, to an individual industry, or to a company.

- Productivity measures are sub-divided into partial and total factor or multi-factor productivity measures. The former are defined as the relationship between output and one input, such as labour or capital, while the latter represents the relationship between output and an index of two or more inputs.

- From an international perspective, Canada's productivity growth performance in recent years has been disappointing. Over the 1989-96 period, output per person employed rose only 4.3 per cent, the smallest increase of the 13 industrial countries for which the US Bureau of Labor Statistics produces data. Canada's poor performance has meant that our relative productivity level has deteriorated, dropping from 82.2 per cent of output per person employed in the United States in 1989 to 80.5 per cent in 1996, although our level is still in the mid-range for industrial countries. OECD productivity statistics paint even a more dismal picture of Canada's business sector productivity performance over the 1979-96 period. Of 22 OECD countries, Canada was 19th in terms of labour productivity, and 21st in terms of capital and total factor productivity growth.

- Productivity is determined by a number of factors, including the quality and availability of natural resources, industrial structure and intersectoral shifts, capital accumulation, the rate of technological progress, quality of human resources, the macroeconomic environment, and the microeconomic environment.

- A country or region's aggregate level of labour productivity reflects the quantity and quality of its natural resource base. For example, aggregate productivity in Newfoundland will be given a boost by the high value added per worker of Hibernia and Voisey Bay projects.

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- The aggregate level of labour productivity is a weighted average of industry labour productivity levels, where the weights are the labour input shares. Given that industries differ in their productivity levels, differences in industrial structure can account for differences in aggregate productivity levels between countries and regions.

- A key determinant of productivity growth is investment in physical capital such as machinery and equipment and structures. The more capital a worker has to work with, the greater the output he can produce.

- The dramatic increase in the average level of formal educational attainment over the past several decades has greatly raised labour quality and contributed to aggregate productivity growth.

- The concept of productivity is increasingly being recognized as more pertinent than competitiveness. Indeed, some economists argue that the whole notion of a "competitive nation" should be abandoned as a term having much meaning for economic prosperity. For example, Michael Porter argues that the principal economic goal of a nation is to produce a high and rising standard of living for its citizens. The ability to do so depends not on the amorphous notion of "competitiveness" but on the productivity with which a nation's resources (labor and capital) are employed. Thus the only meaningful concept of competitiveness at the national level is national productivity.

- Research on the determinants of economic growth and productivity growth suggests that there is a three-way complementarity between physical capital, human capital, and technical progress in the growth process. All are necessary ingredients for improved productivity performance. The new equipment that investment puts in place requires a well trained workforce for efficient operation. Technical progress is embodied in new equipment. Trained workers can only be fully productive if they have the appropriate equipment with which to work. This suggests a three-pronged approach to increasing productivity is needed, with implications for both private sector action and public policy. First, given the central importance of capital accumulation to economic growth, high levels of physical investment are needed. Second, extensive investment in human capital is also needed. Third, technical progress must be promoted by encouraging and facilitating R&D.

- It is estimated that 80 per cent of technical change is embodied in new capital equipment, particularly machinery. Without gross investment, technical progress would be difficult if not impossible. This embodiment means that physical investment is essential for productivity growth.

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- Given the high and growing levels of domestic and international competition that prevail in most industries in Canada, the private sector already has a major incentive to engage in productivity-enhancing activities. The three-pronged framework to productivity advance outlined above is very applicable to private-sector action. To increase productivity, the private sector must increase investment in plant and equipment, train and motivate its workforce, and undertake greater R&D and diffuse the resulting innovations.

- The key responsibility of government in the assurance actual productivity growth is to approach potential growth is the creation of an appropriate macroeconomic and microeconomic environment.

- The high-interest rate, low-growth macroeconomic environment of the first half of the 1990s greatly contributed to our extremely weak productivity performance during this period. If productivity growth is to pick-up in coming years, real interest rates must remain low to foster strong growth in aggregate demand. Appropriate macroeconomic policy is crucial in ensuring that there is no shortfall between actual and trend productivity growth as there was in the 1989-96 period. Appropriate macroeconomic policy leading to the elimination of any output gap and the maintenance of actual growth at potential would boost labour productivity growth from the average 0.6 per cent per year experienced in the 1989-96 period to the trend of around 1.5 per cent per year. The debate centers around what constitutes appropriate macroeconomic policy.

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Productivity: Key to Economic Success

I. Introduction

The basic premise of the report is as follows: economic success or well-being can best be defined by a country or region's living standard, proxied by the level of and trends in per capita real income.[1] High and rising income levels represent economic success while low and falling income levels indicate economic failure. In the short to medium-term, per capita incomes can be increased through an increase in labour input relative to population[2] or through an improvement in terms of trade, that is the relative price a country receives for its exports. But there are limits to possible increases in these variables and hence in the improvements in living standards they can bring.

The only sustained manner in the long run to increase per capita income is by increasing the amount of output produced per worker, that is by raising labour productivity. From this perspective productivity represents the key to economic success. Economists of all leanings accept this basic relationship between productivity and living standards. Indeed, it is one of the few relationships economists agree on.

The rate of labour productivity growth is thus the driving force behind improvements in per capita real incomes and seemingly small declines in productivity growth can accumulate into large differences in the pace of living standards improvement. For example, based on the rule of 72, it takes only 24 years to double real per capita income at 3 per cent annual labour productivity growth, but 36 years at 2 per cent, and 72 years at 1 per cent.

This reality is well recognized by the government. For example, in 1994 the federal Department of Finance (1994:15) released a document entitled *A New Framework for Economic Policy* (the purple book) that stated:

"At the root of the economic problem has been the failure of *productivity* to increase at the rates that prevailed during the post-war years to the mid-1970s"

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[1] Of course, there are other important components of economic well-being, including the unemployment rate, and income variability and uncertainty. For a conceptual framework to assess economic well-being see Osberg (1986) and for an empirical estimation see Sharpe (1997).

[2] The amount of labour input relative to the total population can be increased by a rise in the employment rate or employment/source population ratio (determined by the participation rate and the unemployment rate), a fall in the dependency rate (the working age population/total population ratio), or an increase in the number of hours worked per year per worker

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The objective of this report is to provide a comprehensive overview of knowledge in the productivity field that will contribute to the reader's understanding of the theme that productivity is the key to economic success. The report is aimed at public policy makers and the general public interested in economic issues and represents more a synthesis of the existing literature than a contribution to frontier research.

This report is divided into six parts. Section one provides an overview of the productivity fundamentals, presenting basic data on productivity trends and reviewing the definition and measurement of productivity.

Section two examines the determinants of productivity growth, examining such factors as the natural resource base, industrial structure and intersectoral shifts, capital accumulation, technological change, labour quality, the macro-economic environment and the micro-economic environment.

Section three synthesizes several of the key debates in the productivity literature, looking at the productivity or computer paradox, the relationship between employment and productivity, and the link between productivity and international competitiveness.

Section four briefly looks at actions and policies that can be taken to improve productivity, with particular reference to ways to increase physical investment, develop human capital, and foster technological progress. Section five concludes.

The first appendix discusses a number of frameworks for analyzing productivity growth with particular attention to the neo-classical growth accounting framework and the new knowledge-based growth theory. The second appendix examines a number of additional issues in the productivity literature, including debates on the post-1973 productivity slowdown, productivity convergence, the measurement of service sector productivity, the link between real wages and productivity, and the contribution of productivity to the East Asia economic miracle. The third appendix summarizes the statistical and conceptual issues in productivity measurement.

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II. An Overview of Productivity Trends and Definitions

A. Productivity Definitions and Measurement

i) productivity definitions

Productivity is the relationship between output of goods and services and the inputs of resources, human and non-human used in the production process, with the relationship usually expressed in ratio form. Both outputs and inputs are measured in physical volumes and thus are unaffected by price changes. Constant prices as of one period are used to add up the units of different outputs and inputs in order to combine them into aggregate measures. The ratios may relate to the national economy, to an individual industry, or to a company.[3]

Productivity measures are sub-divided into partial and total factor or multi-factor productivity measures. The former are defined as the relationship between output and one input, such as labour or capital, while the latter represents the relationship between output and an index of two or more inputs.

The most readily available and widely used measure of productivity is labour productivity, the ratio of output to some measure of labour input (employment or hours). This term sometimes creates confusion in the mind of the general public as it may seem to imply that the level of labour productivity or the rate of growth of labour productivity is attributable solely to the effects of labour. In fact, labour productivity reflects the influence of all factors that affect productivity, including capital accumulation, technical change, and the organization of production. While the intensity of labour effort is obviously a factor that does affect labour productivity, it is generally significantly less important than the amount of capital a worker has to work with or the level of production technology.

The concept of total or multi-factor productivity has been developed to measure the contribution of all factors of production to productivity growth. The rates of growth of all inputs are weighted to give one growth rate for the combined inputs. The weights used to aggregate the different input growth rates are generally the inputs' income share of value-added. Total factor productivity growth is defined as the growth rate of output minus the growth rate of the combined inputs (just as labour productivity growth equals output growth minus labour input growth).

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[3] See Kendrick (1977) and Levitan and Werneke (1984) for primers on productivity.

As the growth rate of the capital stock is generally greater than that of employment (and hence the capital/labour ratio is rising), the growth rate of total factor productivity (using labour and capital as inputs) is generally less than the growth rate of labour productivity. This situation arises from the fact that the growth rate of the combined inputs of capital and labour exceeds that of labour alone.

Labour productivity and total factor productivity are both extremely useful concepts. It is incorrect to say that total factor productivity is a superior or preferred measure of productivity compared to labour productivity as the two concepts serve different purposes.[4] For those interested in how efficiently *all* factors of production are used in the production process, then total factor productivity is the relevant productivity measure since it takes account of the productivity of factors of production other than labour, such as capital, intermediate goods, and energy. For those interested in the potential of the economy to raise the standard of living, labour productivity is the relevant productivity measure since it tells how much is produced by each worker and hence how much real income there is to be distributed among the population.[5]

ii) measurement of productivity

Statistical agencies do not gather productivity statistics directly from economic agents but rather construct productivity measures from data on input and outputs. Indeed, almost the entire body of economic statistics collected by statistical agencies - data on output, employment, prices, investment, raw materials, inventories - are used in the compilation of productivity statistics. An examination of the reliability of productivity statistics thus becomes in effect an examination of the reliability of much of the system of economic statistics.

Figure 1 provides a schematic representation of the basic data requirements behind productivity statistics or the building blocks of productivity measurement. At the extreme left is the productivity ratio, defined as the ratio of real output to input. This ratio may be a partial productivity measure, such as labour productivity, where real output is related to only one input, or a multifactor or total factor productivity measure where an index of real output is related to an index of more than one input.

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[4]

[5] For discussion of this point see Baumol, Blackman, and Wolff (1989).

[5] The purple book produced by the Department of Finance (1994:16) got this point wrong when it stated that total factor productivity primarily determines changes in a nation's overall standard of living. Very rapid rates of capital accumulation can result in weak total factor productivity growth, but rapid labour productivity growth and hence large increases in living standards. The East Asia countries have experienced this phenomenon.

As noted above, the income shares of factor inputs are generally used to weigh factor input growth rates to produce an index of total factor input.[6] Inputs in addition to labour that have been included in multifactor productivity calculations are capital, including both fixed capital and inventories, and intermediate goods, including raw materials and energy.

Two types of real output measures can be used to construct productivity indexes - real value added and real gross output. The former defines output as the total incomes of the factors of production (basically labour and capital) in an industry, sector or economy. The latter defines output as the physical output produced by an industry, sector, or economy. At the industry or sectoral level real gross output is comprised of real value added and real intermediate goods. At the aggregate level real gross output is equivalent to real value added as intermediate goods are netted out.

The most appropriate output measure for calculation of industry productivity when labour or labour and capital are included as inputs, is real value added. Use of real gross output may bias the results because of substitution in the production process between intermediate goods and labour or capital. On the other hand, the most appropriate output concept when intermediate goods are included as an input is real gross output.

Real value-added is calculated through a double deflation procedure whereby real intermediate goods are subtracted from real gross output. Real gross output is calculated through the deflation of current dollar gross output by gross output deflators. Real intermediate goods are calculated in a similar manner from current dollar intermediate goods and intermediate goods deflators.

Turning to the input side, labour input, most appropriately measured as total hours worked, is determined by employment and actual average weekly hours. The real capital services arising from the capital stock (fixed capital and sometimes inventories) are derived from current dollar capital stock estimates and capital stock deflators.

From the above discussion five basic building blocks of productivity measurement can be identified - estimates of labour input, including both employment and average weekly hours, estimates of current dollar capital stock; estimates of current dollar intermediate goods; estimates of current dollar gross output; and estimates of product price indices. These

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6 .This weighting scheme is based on the standard competitive equilibrium assumptions that a factor's income share reflects its marginal product and that constant returns to scale prevail. These assumptions have long been criticized by non-neo-classical economists (Cornwall 1987). Interestingly, certain mainstream economists have recently strongly questioned the relevance of these assumptions for the real world, including the standard weighting assigned to factors in multi-factor productivity. See Romer (1987). Also see Hall (1989) for a cogent critique of Solow's basic invariance postulate that factor incomes reflect marginal products.

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product price indices are in turn used to derive deflators for gross output, the capital stock, and intermediate goods (see Figure 1).

A detailed listing of statistical and conceptual measurement issues for the five basic productivity building blocks is given in the Appendix I.

Figure 1
THE BUILDING BLOCKS OF PRODUCTIVITY

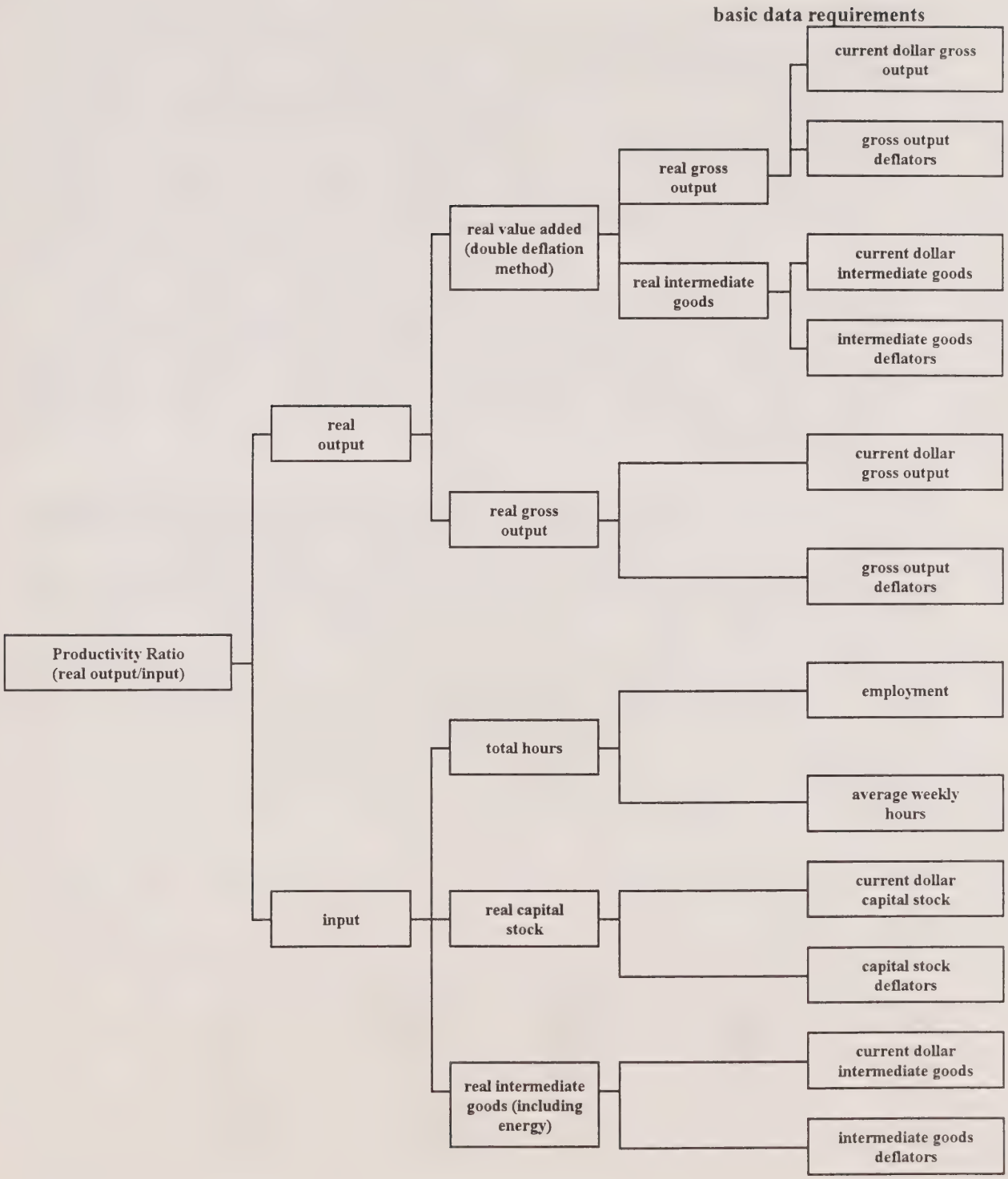

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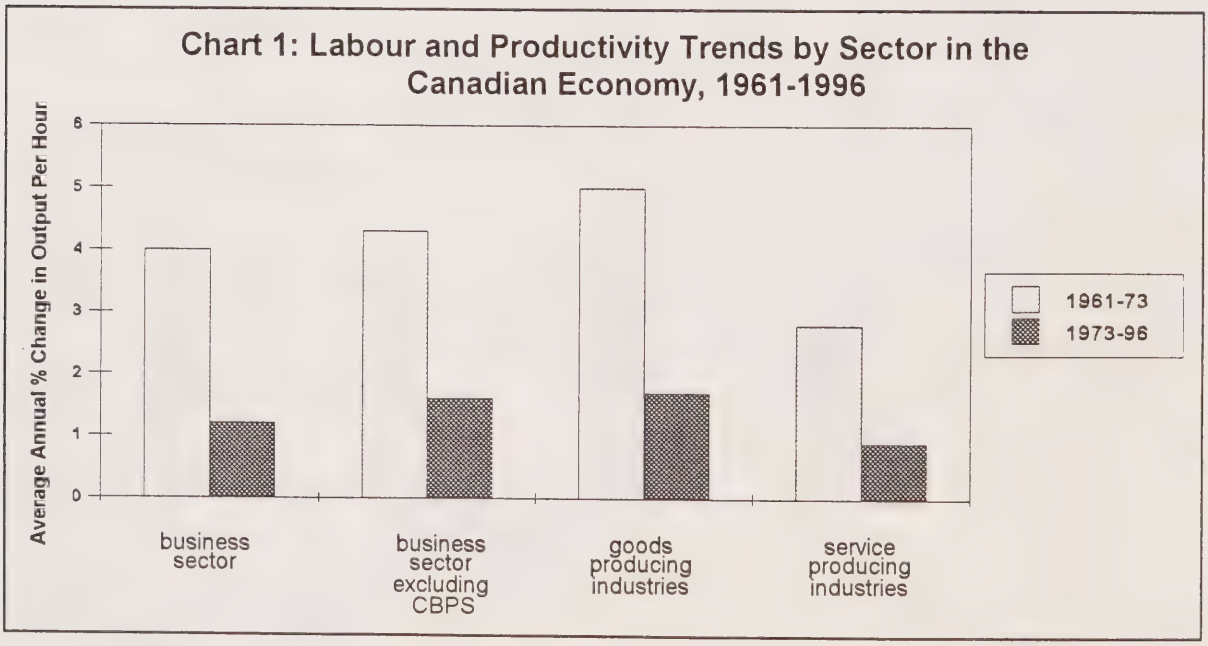
Table 1: Labour Productivity Trends by Sector in the Canadian Economy, 1961-96
(average annual change in output per hour)

	1961-73	1973-96	1973-81	1981-89	1989-96
business sector	4.0	1.2	1.3	1.5	0.7
business sector excluding community, business, and personal services	4.3	1.6	1.4	2.0	1.4
goods producing industries	5.0	1.7	1.6	1.9	1.5
agriculture	6.4	1.9	1.5	2.4	1.8
construction	0.2	0.9	4.2	0.1	-1.8
manufacturing	4.5	1.8	1.7	1.7	2.0
service producing industries	2.8	0.9	1.1	1.3	0.3
transportation and storage	5.1	1.5	-0.1	3.2	1.5
communication	5.6	5.9	7.1	4.8	6.0
wholesale trade	2.7	1.7	1.6	2.5	1.1
retail trade	2.9	0.8	-0.7	2.5	0.5
community, business, and personnal services	1.4	-0.3	0.9	-0.5	-1.3

Note: Official productivity statistics are not published for forestry; fishing; hunting and trapping; mines, quarries, and oil wells; utilities; and finance, insurance, and real estate. Estimates for these industries are included in the business sector goods and service sector estimates.

Source: file supplied by the Input-Output Division of Statistics Canada, July 29, 1997, published as *Aggregate Productivity Measures*, cat. 15-204, Statistics Canada.

Chart 1: Labour and Productivity Trends by Sector in the Canadian Economy, 1961-1996



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B. ***Basic Productivity Trends***

i) aggregate productivity trends

From an historical perspective, productivity growth in Canada has slowed down considerably since 1973. Business sector output per hour is the best indicator of aggregate labour productivity trends as it takes account of the downward drift in average hours worked and excludes the non-business sector where productivity growth is by definition zero.[7] According to Statistics Canada estimates of this measure, productivity growth fell by over two-thirds from 4.0 per cent per year in the 1961-73 period to 1.2 per cent in the 1973-96 period (Table 1). Business sector output per hour growth averaged 1.3 per cent per year in 1973-81, increased slightly to 1.5 per cent in 1981-89, then dropped to 0.7 per cent since 1989.

Business sector total factor and capital productivity growth also fell off significantly after 1973. According to data compiled by the OECD (Table 2), total factor productivity growth fell from 2.0 per cent per year in 1960-73 to -0.1 per cent in 1973-96 while capital productivity growth decreased from 0.2 per cent to -2.0 per cent over the same periods.

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[7] The two basic definitions of labour productivity are output per worker or person at work (not per employee which implies only paid workers), which are based on labour input defined in terms of total employment and total hour worked respectively. When total employment and total hours are growing at the same rate, the growth rate of output per worker and output per hour will be the same. In the postwar period up to 1980, growth in output per hour has been stronger than output per worker because of a decline in the average number of hours worked per year. This decline is explained by falls in the average hours for full-time and part-time workers and by the increasing importance of part-time workers in total employment. Over the 1961-81 period growth of output per worker in the business sector was 0.68 per cent faster than that of output per hour (Table A1) as average annual hours worked per person fell 12.4 per cent or 0.59 per cent per year. Since 1981 the gap between the two measures of labour productivity growth has been much smaller (0.15 per cent per year in 1981-89 and 0.07 per cent in 1989-96) as average hours per worker have been falling at a much slower rate (1.7 per cent between 1981 and 1996 or 0.11 per cent per year), despite the rapid growth in part-time employment. In the 1990s, the negative effect on average hours of the large increase in the part-time employment share is offset by the longer hours worker by full-time workers. Although there may still be large short-term differences between trends in output per worker and output per hour associated with the business cycle, there now appears to be little difference between the trend growth rate in output per worker and output per hour growth because of the stability of average hours. Aggregate labour productivity trends may be defined either on the basis of total economy or business sector developments. The total economy includes public administration and non-marketed education and health services where output is proxied by labour input and productivity growth is by definition zero. This means that total economy productivity growth has a downward bias of 0.2-0.3 percentage points compared to business sector productivity growth because of the drag on measured productivity growth of the non-business sector. In the 1980s, this bias for output per hour productivity measures was 0.23 percentage points (1.45 per cent per year for business sector versus 1.22 per cent for the total economy), and in the 1990s 0.25 points (0.68 per cent versus 0.43 per cent).

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Chart 2: Growth of Real GDP Per Employed Person in 13 OECD Countries, 1989-96

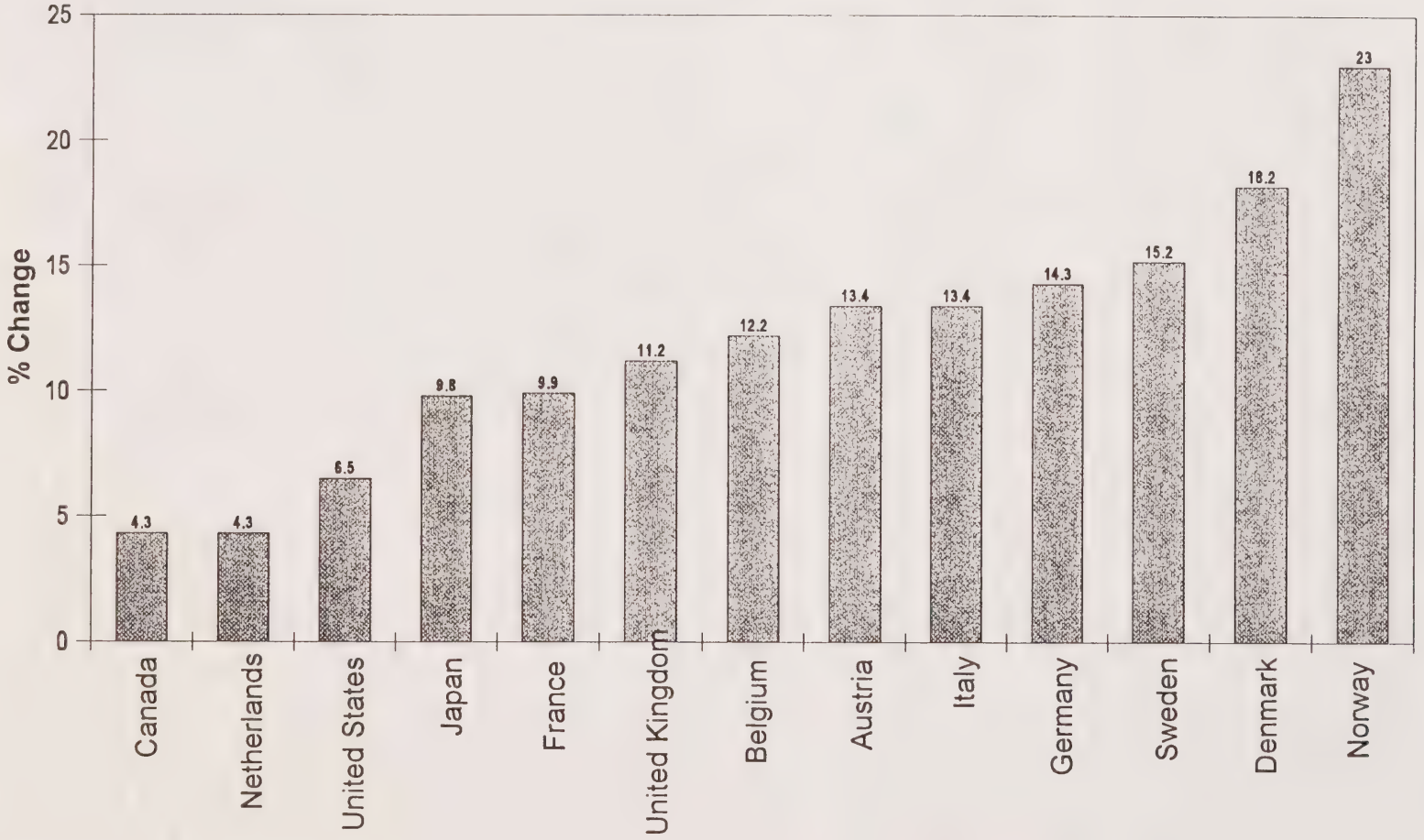

Table 2: Productivity in the Business Sector in OECD Countries (percentage changes at annual rates)

	Total Factor Productivity (a)			Labour productivity (b)			Capital productivity		
	1960(c)-73	1973-79	1979-96(d)	1960(c)-73	1973-79	1979-96(d)	1960(c)-73	1973-79	1979-96(d)
United States	2.5	0.1	0.5	2.6	0.3	0.8	2.3	-0.3	-0.2
Japan	5.7	1.1	1.1	8.4	2.8	2.2	-2.3	-3.6	-2.1
Germany (e)	2.6	1.8	0.6	4.5	3.1	1.1	-1.4	-1.0	-0.5
France	3.7	1.6	1.3	5.3	2.9	2.2	0.6	-1.0	-0.6
Italy	4.5	2.0	1.1	6.4	2.8	2.0	0.5	0.3	-0.6
United Kingdom	2.6	0.6	1.5	3.9	1.5	1.9	-0.3	-1.5	0.6
Canada	2.0	0.6	-0.2	2.9	1.5	1.0	0.2	-1.0	-2.4
Total of above countries (f)	3.4	0.8	0.8	4.5	1.6	1.4	0.5	-1.1	-0.7
Australia	2.2	1.1	0.8	3.3	2.4	1.3	0.1	-1.4	-0.1
Austria	3.1	1.0	1.0	5.5	3.0	2.3	-2.0	-3.1	-1.6
Belgium	3.8	1.3	1.2	5.3	2.7	2.1	0.6	-1.8	-0.9
Denmark	2.3	0.9	1.2	3.9	2.4	2.1	-1.4	-2.6	-0.8
Finland	4.0	1.9	2.6	5.0	3.2	3.5	1.4	-1.6	0.0
Greece	2.5	0.7	-0.3	9.0	3.3	0.6	-8.8	-4.2	-2.0
Ireland	4.5	3.4	2.8	5.0	4.0	3.4	2.5	0.7	0.4
Korea		3.0	2.6		6.6	5.6		-3.3	-2.7
Netherlands	3.5	1.7	1.1	4.9	2.6	1.6	1.0	-0.1	0.3
New Zealand	1.5	-1.4	1.1	2.1	-1.1	1.3	0.6	-1.9	0.8
Norway (g)	2.3	1.4	0.2	3.8	2.7	1.6	0.5	-0.1	-1.5
Portugal	4.1	-0.7	1.0	7.5	0.5	2.4	-2.5	-3.2	-1.8
Spain	3.2	0.9	1.6	6.0	3.3	2.8	-4.0	-5.3	-1.6
Sweden	1.9	0.0	1.1	3.7	1.4	2.0	-2.2	-3.2	-1.0
Switzerland	2.2	-0.2	-0.1	3.3	0.9	0.4	-1.4	-3.5	-1.6
Total of above smaller countries (f)	3.0	1.3	1.3	5.0	3.2	2.5	-1.6	-2.8	-1.2
Total of above OECD countries (f)	3.3	0.9	0.9	4.6	1.8	1.6	0.3	-1.4	-0.8
Total of above European Union countries (f)	3.2	1.4	1.1	5.1	2.6	1.8	-0.7	-1.5	-0.5

a) TFP growth is equal to a weighted average of the growth in labour and capital productivity. The sample-period averages for capital and labour shares are used as weights.
b) Output per employed person.
c) Or earliest year available. *i.e.* 1961 for Australia, Greece and Ireland; 1962 for Japan and the United Kingdom; 1964 for Spain; 1965 for France and Sweden; 1966 for Canada and Norway; 1967 for New Zealand; 1969 for the Netherlands; 1970 for Belgium; 1975 for Korea.
d) Or latest available year. *i.e.* 1991 for Norway; 1993 for Portugal; 1994 for Germany, Italy, Austria, Greece, Ireland, Korea and Switzerland and 1995 for Japan, France, the United Kingdom, Australia, Belgium, Finland, the Netherlands, New Zealand, Spain, and Sweden.
e) The two first averages concern western Germany. The percentage changes for the period 1976-96 are calculated as the weighted average of west German productivity growth between 1979 and 1991 and total Germany productivity growth between 1991 and the latest year available.
f) Aggregates are calculated on the basis of 1992 GDP for the business sector expressed in 1992 purchasing power parities.
g) Mainland business sector (*i.e.* excluding shipping as well as crude petroleum and gas extraction).

Source: Annex Table 58, *OECD Economic Outlook, June 1997*.

From an international perspective, Canada's productivity performance in recent years has been disappointing. Chart 2, based on data from the US Bureau of Labor Statistics shows that over the 1989-96 period, output per person employed rose only 4.3 per cent. This was the smallest increase (tied with the Netherlands) of the 13 countries for which the Bureau of Labor Statistics (BLS) produces data (the average increase was 12.0 per cent). Canada's poor performance has meant that our relative productivity level has deteriorated, dropping from 82.2 per cent of output per person employed in the United States in 1989 to 80.5 per cent in 1996 (Table 3).

OECD productivity statistics (Table 2) paint even a more dismal picture of Canada's business sector productivity performance over the 1979-96 period, as summarized below.

- In terms of labour productivity, Canada experienced the second worst rate of growth in output per person employed in the G-7 (after the United States) and was 19th of 22 OECD countries.

- In terms of capital productivity, Canada had the worst performance in the G-7 and was 21st of 22 OECD countries (only Korea did worse).

- In terms of total factor productivity, Canada again had the worst performance in the G-7 and was 21st of 22 OECD countries (only Greece did worse).

Canada's performance in manufacturing has been equally poor. Since 1973, Canada has had by far the weakest productivity growth in this sector among G-7 countries. Output per hour growth has averaged 1.8 per cent per year compared to the G-7 unweighted average of 3.2 per cent (Table 4). This has meant that Canada's relative productivity level in manufacturing has fallen sharply.

ii) sectoral productivity trends

The post-1973 productivity slowdown affected most sectors of the Canadian economy. Of the eight one-digit SIC industries for which official data are available (Table 1), six (agriculture, manufacturing, transportation and storage, wholesale trade, retail trade, and community, business and personal services) experienced significantly lower growth in output per hour after 1973. The exceptions were communications and construction, which have both seen an improvement in productivity growth since 1973. Non-official data indicate that the slowdown also affected forestry, fishing, hunting and trapping, mines, quarries and oil wells, utilities, and finance, insurance and real estate.

There have historically been large differences in labour productivity growth rates across industries. In the 1973-96 period, communications enjoyed by far the most rapid productivity growth (6.0 per cent per year), while community, business and personal services had the worst (-0.3 per cent per year). The productivity growth rates for the other one-digit SIC industries for which official data are available were between 0.8 and 1.9 per cent per year.

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Table 3: Real GDP Per Capita and Output Per Person Employed in 13 OECD Countries

	Per Cent of U.S. Level			
	GDP Per Capita		GDP Per Employed Person	
	1989	1996	1989	1996
United States	100	100	100	100
Canada	81.7	76.7	82.2	80.5
Germany	79.4	81.7	86.1	92.4
Norway	78.9	90.8	77.8	89.8
Japan	76.5	81.9	75.0	77.3
Belgium	75.3	77.6	96.2	101.3
Denmark	74.8	79.1	71.6	79.5
France	74.6	74.8	91.5	94.4
Austria	73.3	76.3	83.4	88.9
Sweden	72.3	68.0	65.8	71.2
Italy	69.8	71.6	90.7	96.6
United Kingdom	69.7	69.4	72.4	75.6
Netherlands	67.7	72.4	79.9	78.3

Sources:

All 1960 to 1995 data are based on U.S. Bureau of Labour Statistics unpublished data, *Comparative Real Gross Domestic Product Per Capita and Per Employed Person, Fourteen Countries, 1960-1995*, April 1997. Real GDP growth for 1996 from *OECD Economic Outlook*, June 1997; population growth for 1996 based on population statistics from *OECD Main Economic Indicators*, December 1995 and 1996; and employment for 1996 from *OECD Employment Outlook, June 1997*.

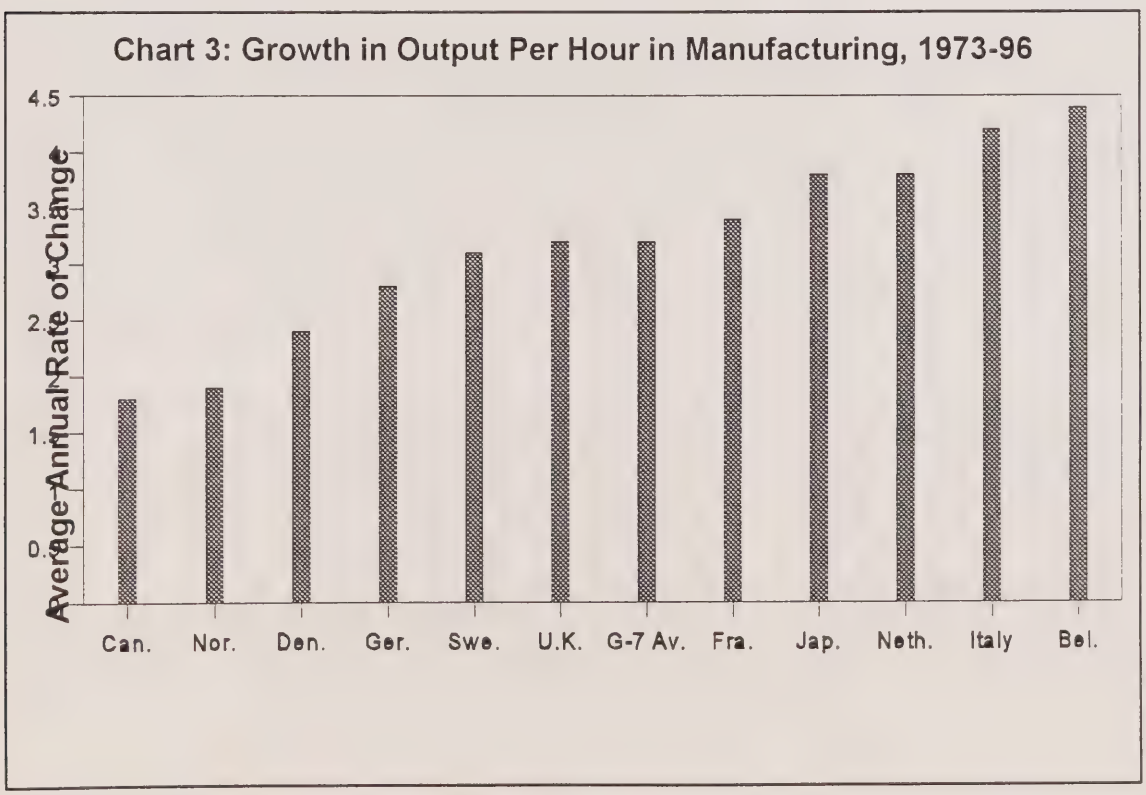
Table 4: Growth in Output Per Hour in Manufacturing

(Average annual rate of change)

	1960-73	1973-81	1981-89	1989-96	1973-96
United States	n/a	n/a	3.2	2.2	n/a
Canada	4.5	1.7	1.7	2.0	1.8
Japan	10.0	4.0	3.9	3.5	3.8
France	6.8	3.8	3.7	2.7	3.4
Germany	5.8	3.2	2.3	2.9	2.8
Italy	6.4	5.1	4.0	3.4	4.2
United Kingdom	4.2	1.3	5.3	3.1	3.2
unweighted G-7 average	6.3	3.2	3.4	2.8	3.2
Belgium*	6.9	6.2	4.3	2.1	4.4
Denmark*	6.4	4.0	0.7	2.7	2.4
Netherlands*	7.3	4.9	3.9	2.5	3.8
Norway	4.8	1.6	2.7	1.3	1.9
Sweden	6.4	2.1	3.1	4.2	3.1

*Note: For Belgium and Netherlands, the latest available year of data is 1995, for Denmark 1993.

Source: International Comparisons of Manufacturing Productivity and Labour Cost Trends, 1996, August 15, 1997, Bureau of Labour Statistics.



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The behavior of productivity in the important community, business and personal services(CBPS) sector is particularly disturbing. Between the 1989 cyclical peak and 1996 output per hour in this sector fell 1.3 per cent per year, after falling 0.5 per cent per year in the 1980s. This decline in the absolute level of productivity affected all industries within the CBPS sector in the 1990s (Table): accommodation, food and beverage (-1.9 per cent per year), amusement and recreation services (-1.4 per cent), business services (-1.1 per cent per year), health services (-1.0 per cent),education and related services (-0.6 per cent), and personal, household and other services (-0.5 per cent).

As this sector accounts for over one quarter of total business sector hours worked, this development exercised a significant downward influence on total business sector productivity. This had serious consequences for real wages, since real wage growth is determined by long-run labour productivity growth. Excluding the CBPS sector, business sector output per hour advanced 1.4 per cent per annum over the 1989-96 period, 0.7 percentage points above the actual 0.7 per cent (Table 1). In the 1980s the gap was 0.5 points (2.0 per cent versus 1.5 per cent), while in the 1973-81 period it was only 0.1 point.

Possible explanations for this situation include the underestimation of real output in the sector due to measurement problems; an intrinsic inability of certain service industries to raise measured productivity because of the one-to-one personal relationship between service provider and client; and employment shifts from high productivity activities to low productivity activities within the community, business and personal services sector. More research is needed on this issue.

The Centre for the Study of Living Standards has recently developed and posted on its website a comprehensive productivity data base. Using Statistics Canada labour input, capital stock and output data, this data base provides estimates of labour productivity levels (both output per worker and output per hour), capital productivity levels, and total factor productivity indexes for the years 1984-95 inclusive for Canada and for the 10 provinces, giving as much industry disaggregation as confidentially rules permit. The average annual growth rates for labour, capital, and total factor productivity for all one-digit SIC industries at the national level for the 1984-89, 1989-95 and 1984-95 periods are given in Table 5. Tables A2-A4 in the Appendix provide more detailed industry data.

In addition to the variability in productivity growth rates, there are large differences in labour productivity levels across sectors. At the one-digit-SIC industry level, the value (1986$) of output per hour ranged from a high of $65.82 in mining, quarries, and oil wells to a low of $12.04 in agriculture (Table 6). These productivity level differences are explained by industry differences in capital intensity, wage rates, and the number of self-employed (which affects the willingness to work for low returns).
Output per hour levels within manufacturing, community, business and personal services, and finance, insurance and real estate are provided in Tables A5-A7 in the Appendix.

Table 5: Productivity Growth Rates in Canada by Industry Average annual growth rates.

	Output per hour of Labour			Output per unit of Capital Stock			Total Factor Productivity (based on hours)		
	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95
Agriculture	3.06	2.61	2.82	8.66	5.46	6.90	5.64	3.78	4.62
Fishing and trapping	2.40	2.08	2.22	4.68	-3.98	-0.13	6.36	-3.54	0.84
Logging and forestry	3.25	-5.15	-1.42	3.78	-1.38	0.93	3.44	-3.92	-0.64
Mining, quarries and oil wells	0.60	4.56	2.74	4.93	-1.38	0.93	3.36	3.96	3.69
Manufacturing	0.80	2.59	1.77	-2.15	2.09	0.14	-0.57	2.35	1.01
Construction	-2.31	0.18	-0.96	0.08	-3.61	-1.95	-1.12	-1.78	-1.48
Transportation and storage	0.66	0.42	0.53	3.15	0.05	1.44	1.48	0.30	0.84
Communication and other utilities	0.14	3.71	2.08	2.08	0.19	1.04	1.30	1.55	1.43
Trade	2.28	2.00	2.13	1.67	-7.22	-3.28	1.49	-3.13	-1.06
FIRE (minus imputations)	0.56	-0.20	0.15	-5.49	-2.96	-4.12	-3.21	-2.06	-2.59
Commercial, business, and personal services	-0.49	-0.87	-0.70	-1.40	-2.35	-1.92	-0.82	-1.44	-1.16
Government services	-0.92	1.88	0.60	-0.50	-1.85	-1.24	-0.80	0.79	0.16
Total economy (minus government services and imputations)	0.48	0.93	0.72	0.87	-0.94	-0.12	0.65	0.07	0.34

Sources: Centre for the Study of Living Standards Productivity Tables (http://www.csis.ca/ptables.html) - based on Statistics Canada Labour Force Survey, GDP, and Capital Stock data July 1997. Labour Share of GDP based on Statistics Canada, Survey of Employment, Payrolls and Hours, and GDP data.

Table 6: Labour Productivity Relatives by Sector, Canada & the Regions, 1995

(Output per hour)

Industry	Canada (1986$)	Atlantic	Quebec	Ontario	Manitoba	Sask.	Alberta	B.C.
					Canada=100			
Agriculture	12.04	91.69	108.63	101.87	76.02	95.00	100.79	124.99
Fishing & Trapping	14.63	75.30	117.79	91.52	237.94	131.42	n/a	190.96
Logging & forestry	15.52	99.36	82.21	116.66	66.46	79.62	111.17	106.59
Mining, quarries & oil wells	65.82	37.82	45.18	50.08	30.94	131.80	137.35	121.17
Manufacturing	25.69	72.20	88.65	111.99	75.17	69.92	119.85	89.11
Construction	20.30	98.00	109.61	89.97	106.98	108.66	99.00	103.40
Transportation & storage	21.20	73.60	76.90	90.12	112.14	113.76	137.51	132.29
Communication	38.71	108.60	123.05	87.59	83.40	125.16	98.57	96.91
Other Utilities	63.72	100.51	112.94	75.80	101.61	84.55	182.57	101.40
Trade	16.46	75.61	91.11	112.80	90.66	85.57	94.58	102.95
FIRE minus imputations	26.82	87.32	97.29	96.12	93.20	105.48	129.62	102.66
Commercial, business & personal services	14.86	87.06	104.82	103.48	95.88	90.94	92.98	94.82
Government services	23.13	101.07	98.87	100.49	103.74	90.12	104.12	94.82
Total Economy	22.68	83.70	93.71	101.07	86.86	93.83	123.17	100.08
Total Economy minus government services and imputations	20.56	80.43	95.93	102.35	86.19	93.99	119.43	97.20
Goods producing industries	25.90	75.72	91.12	101.68	71.11	85.80	143.01	94.52
Services producing industries	21.30	88.04	94.94	100.61	95.13	97.41	110.72	103.68

Note: FIRE in Atlantic is not minus imputations. Blank space indicates data not available due to confidentiality.
Sources: Centre for the Study of Living Standards Productivity Tables (http://www.csls.ca/ptables.html) - based on Statistics Canada Labour Force Survey and GDP data July 1997.

iii) productivity by region

The regional variation in productivity levels and growth rates is much less than the sectoral variation. Regional aggregate labour productivity levels in 1985 ranged from a low of 83.7 per cent of the national average in Atlantic Canada to a high of 123.2 per cent in Alberta (Table 6). Equally, over the 1984-95 period regional growth rates for aggregate labour productivity ranged from a minimum of 0.2 per cent per year in British Columbia to a maximum of 1.3 per cent in Saskatchewan (Table A8 in the Appendix). Tables A9-A20 provide regional productivity growth rates for all one-digit SIC industries.

III. Determinants of Productivity Growth in the Canadian Context

This section of the report reviews the determinants of productivity growth and comments on their contribution in the Canadian context. Seven specific determinants are identified and discussed: the natural resource base, industrial structure and intersectoral shifts, capital accumulation, the rate of technological progress, and the quality of human resources, the macroeconomic environment, and the microeconomic environment

A. Natural Resource Base

A country or region's aggregate level of labour productivity reflects the quantity and quality of its natural resource base. For example, the high level of output per hour in Alberta (Table 6) reflects the concentration of the oil and gas industry in this province and the high value added (which includes economic rent) per worker generated by this industry. Similarly, the above average labour productivity levels in British Columbia reflect that province's rich forestry resources, while the below average productivity levels in Atlantic Canada are in part linked to that region's more limited resource base. Changes in aggregate productivity levels over time can also be due to the enrichment or depletion of the resource base. For example, aggregate productivity in Newfoundland will be given a boost by the high value added per worker of Hibernia and Voisey Bay projects.

But the link between a country or region's resource base and its long-run productivity levels is complex. Rich natural resources are no guarantee of sustainable high productivity levels, just as a poor resource base by no means condemns a country or region to low productivity. Certain countries and regions in the past have failed to properly husband and develop non-renewable resources or have squandered potentially renewable resources (e.g. the Atlantic cod fishery). Equally, certain countries such as Japan have used their ingenuity to overcome meager resources to achieve high productivity levels. Indeed, some even suggest that Japan's poor resource base contributed to its ultimate enrichment by leaving no alternative but the development of the country's human capital and industrial base.

The natural resource base affects the seasonal natural of economic activity and this in turn can influence productivity. For example, certain natural resources such as forests or fish can only be exploited during part of the year, leaving capital idle using periods of down time. Capital productivity in such a sector is thus lower than in a sector where the capital stock is fully utilized throughout the year. As employees, unlike capital, can be laid off in the off-season in resource industries, labour productivity is less affected by this seasonality, although employment levels and unemployment are greatly influenced.

B. Industrial Structure and Intersectoral Shifts

The aggregate level of labour productivity is a weighted average of industry labour productivity levels, where the weights are the labour input shares. Given that industries differ in their productivity levels, differences in industrial structure can account for differences in aggregate productivity levels between countries and regions. For example, Atlantic Canada

has traditionally has a lower level of aggregate labour productivity than the Canadian average. Part of this situation is explained by the greater concentration of low-productivity level manufacturing industries such as fish processing in Atlantic Canada. Lower productivity levels, expressed in dollars, can reflect both lower physical output per worker and lower wages.

Aggregate labour productivity growth can hence be decomposed into two basic components - changes in industry-specific labour productivity growth rates (rate effects) and movement of employment between sectors with different average labour productivity levels (level effects). Faster growth of employment in industries with above average productivity levels boosts aggregate labour productivity growth while slower growth reduces it.

Growth accounting studies have shown that the movement of labour out of low productivity level agriculture into higher productivity level non-farm activities has contributed significantly to aggregate productivity growth in the postwar period. For example, the decline of agriculture's share of business sector labour input in Canada from 40 per cent in 1946 to 11 per cent in 1973 is estimated to have raised business sector labour productivity growth in the Canadian economy by more than one half a percentage point per year over the 1946-73 period. Since 1973 the decline in agriculture's share of total hours in the business sector has been much less dramatic (to 6 per cent in 1996), so this source of aggregate productivity growth has been greatly diminished. The gradual winding down of the employment shift from farm to non-farm activities is thus a non-trivial factor in explaining slower aggregate productivity growth in the post-1973 period. This phenomenon is not, strictly speaking, a measurement problem or error as no mismeasurement of industry productivity growth is occurring. However, it certainly qualifies as a measurement issue because of the effect employment shifts have on aggregate productivity growth rates.

The 1980s and 1990s have seen rapid growth of employment in low productivity level service industries and declines in employment in high productivity goods industries. The share of community, business and personal services (where output per hour in 1996 was only 63 per cent the business sector average, down from 84 per cent in 1981) in total business sector hours increased from 18.5 per cent in 1981 to 22.8 per cent in 1989 to 26.7 per cent in 1996.

Sharpe (1990) estimated that employment shifts have reduced aggregate labour productivity growth by around one half a percentage point in the 1980s relative to the 1970s. The concentration of employment growth in low productivity service industries and the fall in employment in high productivity mining account for this development. In other words, industry-specific labour productivity growth has been significantly better in the eighties than indicated by aggregate growth rates. A similar negative shift effect appears to have taken place in the 1990s.

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C. Capital Accumulation

A key determinant of productivity growth is investment in physical capital such as machinery and equipment and structures. The more capital a worker has to work with, the greater the output he can produce.[8]

A distinction in economic theory is often made between increases in the capital/labour ratio (movement along a production function) where the technology is unchanged and changes in technology (shifts in the production function) where the capital/labour ratio is constant. In the real world, it is very hard to distinguish these two effects because technical progress is embodied in capital equipment so increases in the capital/labour ratio mean that new technologies are being integrated into the production process. Indeed, it is estimated that 80 per cent of technical change is embodied in new capital equipment, particularly machinery (Summers and DeLong, 1992). Without gross investment, technical progress would be difficult if not impossible.

In absolute terms, the rate of growth of real business non-residential gross investment has fallen off in Canada in recent decades, from a 8.5 per cent average annual rate of increase in 1973-81 period to 3.2 per cent in 1981-89 to 1.1 per cent in 1989-95. As a share of GDP, this measure of investment rose from 9.7 per cent in 1973 to 13.8 per cent in 1981, and has since been stable, at 13.9 per cent in 1989 and 13.8 per cent in 1995.[9] This stability in the share of investment means that the rates of growth of investment has mirrored that of output growth in the 1980s and 1990s.

In contrast to the solid performance of real gross non-residential business investment relative to GDP, growth in nominal gross non-residential business investment has lagged nominal output growth in the 1980s and 1990s, with the investment share falling from 15.8 per cent in 1981 to 12.6 per cent in 1989 to 10.1 per cent in 1995. The falling relative price of investment goods associated with the massive decrease in the price of information technology accounts for the divergence between the constant and current dollar investment shares.

The public sector capital stock also contributes to productivity growth in the private sector. Better public infrastructure such as roads, airports, public transit, sewers, and in a more indirect manner hospitals and educational facilities, can improve the operational efficiency of business. Real gross government fixed investment in Canada peaked around 4

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[8] It should be noted that different capital/labour ratios account for much of the differences in labour productivity levels by firm size. Large firms tend to be more capital intensive and therefore have higher levels of output per worker. Firm size is not an independent determinant of productivity, but rather is a proxy for certain firm characteristics.

[9] In contrast to trends in gross investment, net investment, defined as gross investment minus depreciation, has fallen as a share of GDP in recent years because of increased depreciation asssociated with the shift in investment patterns to assets with shorter lives such as information technology.

per cent of GDP in the mid-1960s. It then entered a period of relative decline, falling to 3.1 per cent in 1973 and to a low of 2.4 per cent in 1981. Since then it has been on a slight upward trend, reaching 2.6 per cent in 1989 and 2.9 per cent in 1995.[10]

D. Rate of Technical Progress

The rate of technical progress is the key long-run determinant of productivity growth. Unfortunately, it is very difficult to estimate this variable so there is much uncertainty about its trend. If one takes total factor productivity growth as an approximation of the rate of technical progress, then current estimates suggest there has been no technical progress since the early 1980s. Given the apparently rapid pace of technological change, it is difficult to accept this conclusion. This implies that other factors such as the poor macroeconomic environment must be offsetting the positive influence of the rate of technical progress on total factor productivity growth.

The rate of technical progress is determined by the rate of discovery of new product and process innovations and the pace of the diffusion of those innovations. An indication of the rate of development of new innovations may be obtained from the resources devoted to research and development spending, on the assumption that there is a positive relationship between resources and discoveries. Based on a review of the evidence, Griliches (1988) suggests that, as a rule of thumb, a 1 per cent increase in the R & D capital stock leads to a rise in output of between 0.05 per cent and 0.15 per cent. The proportion of GDP Canada devotes to R&D has been stable at around 1.4 per cent in recent years. From an international perspective however, this proportion is low.

Firms in Canada can in principle draw upon the world supply of innovations, and given Canada's small size, we account for only a proportion (one estimate is 1-2 per cent) of the world supply of innovations. This may mean that trends in R&D in Canada may not be particularly relevant for the rate of technical progress in this country. What matters is our ability to exploit foreign technologies. A counterargrument is that without actually engaging in R&D activities, Canadian firms are not able to adopt foreign technology. The truth probably lies somewhere in the middle.

E. Quality of Human Resources

The labour input measure used in official productivity statistics are quality unadjusted, that is, workers are aggregated without regard for their characteristics. Consequently, changes in average labour quality can directly affect productivity.[11] The dramatic increase in the average level of formal educational attainment over the past several decades has greatly raised labour quality and contributed to aggregate productivity growth. Studies have shown that the post-1973 productivity slowdown in Canada has not been due to any

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[10] The current dollar share of gross government fixed investment in GDP has followed a similar trend.

[11] A alternative approach advocated by Jorgenson is for increases in labour quality to increase labour input (or more efficiency units of labour). This approach by definition produces lower productivity growth.

deterioration in labour quality, at least as proxied by formal educational attainment (see Canadian Labour Market and Productivity Centre, 1989-90).

The average experience of the workforce, another component of labour quality, has been increasing in the 1980s and 1990s, due to the ageing of the population. This has offset any deterioration that occurred in the 1970s when the baby boom generation was entering the labour force.

While current trends in the observed characteristics of the labour force should in principle foster productivity growth, it has been suggested that there may have been a deterioration in labour quality which is not captured by the traditional proxies for labour quality (educational attainment and workforce experience). For example, a decline in the average quality of high school graduates due to falling educational standards would not be picked up in the labour quality indicators, but would in effect have negative consequences for productivity.

Unfortunately, a lack of time series data on trends in the effective quality of graduates in Canada makes a detailed examination of this issue not possible.[12] What limited data there is suggests no major changes in the educational standards. Most observers believe that it is unlikely that there has been any significant deterioration in labour quality. What may have happened is that the skill and educational demands on the workforce have substantially increased, so that the workforce's deficiencies in the area of education and training appear more evident.

Industry specific productivity trends could also be explained by changes in labour quality. For example, if there has in fact been a deterioration in the average quality of new labour force entrants, productivity growth in industries which employ large numbers of younger workers would be reduced. This could be a possible explanation for the negative productivity growth in community, business and personal services.

In addition to the education and training of the workforce, the quality of management quality also has a significant effect on productivity growth. A firm where management has state-of-the-art knowledge in areas such as financing, marketing, and innovation has an obvious competitive advantage over firms whose knowledge in lagging. Work by John Baldwin (1995) of Statistics Canada identified the level of management training as an important factor differentiating innovating and non-innovating firms. In the long run, it is the innovating firms that experience growth.

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[12] Bishop(1989) found evidence of declining labour quality in the United States from standardized test scores and concluded this factor was an important explanation of the productivity slowdown.

F. Macroeconomic Environment

Output growth can be decomposed into labour input growth and productivity growth. Thus increases in output growth arising from an increase in spending call forth roughly proportional increases in both labour input and productivity, at least until the potential output of the economy is attained. An economy operating below capacity will experience both unemployment and below trend productivity growth.

Economists are in general agreement that a "favourable macro-economic environment" for productivity growth corresponds to a situation where there is no output gap and actual output is growing at potential. Such a situation is usually characterized by low real interest rates.

A comparison of aggregate productivity performance in Canada between the 1980s and the 1990s illustrates well the crucial importance of the macroeconomic environment for productivity growth. Between the 1981 and 1989 cyclical peaks output grew at a 3.2 per cent average annual rate, with employment and productivity growth about equally contributing to the increase in output (1.7 per cent employment growth and 1.5 per cent output per worker growth).

In the 1990s, employment and productivity have again roughly equally contributed to output growth, but output growth has been much slower than in the 1980s- only 1.2 per cent per year between 1989 and 1996, the worst period for economic growth since the Great Depression. Thus productivity growth has been a meager 0.6 per cent per year. Had output growth continued in the 1990s at the pace of the 1980s,[13] it is likely that productivity growth would have also been comparable to that experienced in the 1980s. From this perspective, the fall-off in productivity growth in the 1990s compared to the 1980s can be explained by due to the deterioration in the macro-economic environment.

Economists differ on what macro-economic conditions lead to a "favourable economic environment". The current economic orthodoxy, as put forward by the Department of Finance and the Bank of Canada, is the belief that balanced budgets, declining government debt levels, and price stability are essential for a "favourable macroeconomic environment" as such conditions promote investment by improving business confidence and lowering real interest rates. Other economists place less emphasis on the three variables mentioned above and stress demand-side policies to increase spending as the key to keeping the economy on its potential growth path.[14]

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[13] Whether this would have been possible depends on what happened to potential output growth in the 1990s. If potential output continued at 3 per cent in the 1990s, as Dungan, Murphy, and Wilson (1997) argue it did, then a continuation of the actual growth rate of the 1980s in the 1990s would have been possible if the aggregate demand had been there. On the other hand, if potential growth fell off for some unexplained reason, then a non-inflationary 3 per cent growth path would not have been possible.

[14] See, for example, Osberg and Fortin (1996) and the 1997 alternative federal budget put forward by the Canadian Centre for Policy Alternatives and Choices: A Coalition for Social Justice (1997).

G. The Microeconomic Policy Environment

A country's microeconomic policy environment has great potential to foster or hinder private sector productivity performance. Broadly defined, the micro-economic policy environment includes all policies that affect the behavior at the firm level. This includes trade policy, tax policy, industrial policy, competition policy, and policies on privatization, intellectual property, regulation, and foreign ownership.

Obviously, there are no general rules that can be formulated for microeconomic policy to indiscriminately follow to maximize productivity growth. Sound judgment is always necessary. But experience suggests that in most cases microeconomic policies that let allow market forces to flourish will in the long run lead to the most favourable productivity outcomes (Miller and Schmitz, 1997). Micro-economic policies that have been found to promote productivity growth include reduction of trade barriers,[15] deregulation of non-competitive markets, and privatization of government enterprises.

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[15] A recent study by Baldwin and Caves (1997) found that international competition limits the amount of productive inefficiency that is viable in domestic firms while trade barriers relax this pressure for efficiency. Also see Krauss (1997) on the benefits of free trade on growth.

IV. Key Issues in the Productivity Literature

The economics profession has in recent years moved away from questions related to short-run fluctuations and stabilization policy and has increasingly tackled questions related to long-run economic growth. As productivity growth is the key determinant of long-run growth, it has received a growing amount of attention from the best economists in the profession.

This section of the report reviews a number of the most important debates that have animated the productivity literature in recent years, namely the post-1973 productivity slowdown, the productivity convergence, productivity measurement issues, the productivity or computer paradox, the relationship between employment and productivity, the link between productivity and international competitiveness, real wages and productivity, and the contribution of productivity growth to the East Asia miracle.

A. The Productivity Paradox: the mysterious link between computers and productivity[16]

Consider the following development. Between 1992 and 1995, investment in office computers in the Canadian service sector rose 64.2 per cent in real terms, but total factor productivity advanced a meager 1.2 per cent. Even more perplexing as Table 8 shows, the service industries with the highest proportion of computer investment in total investment tended to experience the worst total factor productivity growth! Was not the explosion of computer power supposed to increase productivity growth? What accounts for this paradoxical behaviour of productivity growth, a development economists have labelled the "productivity paradox"?

There are no shortage of explanations for this development. At a recent international conference on the issue organized by the Ottawa-based Centre for the Study of Living Standards (papers are available at www.csls.ca), expert opinion was solidly divided. Three basic hypotheses were advanced. Some argued that the benefits of information technology (IT) are already here, but are just not being captured by the statistical system. Others said to have patience, pointing out that there are inevitable lags associated with the emergence of the benefits of IT and these benefits are just around the corner. Still other believed that IT has been vastly oversold as a source of productivity improvement.

i) the mismeasurement hypothesis or "the benefits of IT are already here"

The obvious starting point for any attempt to unravel the mysterious relationship between computers or information technology (the two terms will be used interchangeably) and productivity lies in the area of measurement, or more accurately mismeasurement. The case that the benefits of computers are already here, but are just not being captured correctly has a certain intuitive appeal. Three strands can be identified to

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[16] This section draws from Sharpe (1997).

this argument. First, for a number of reasons discussed in the previous section, statistical agencies may be underestimating increases in real or inflation-adjusted output (and hence productivity) arising from computerization, particularly in the service sector.

A comparison of the banking and telecommunications industries sheds light on this output measurement issue. Both industries have made significant IT investments. The number of transactions per worker in both industries has increased tremendously. Output in the telecommunications industry is defined on the basis of the number of transactions (e.g. number of calls) and of the basis of access. Output in banking, on the other hand, is defined on the basis of the margin between the interest charged for loans and paid for deposits, not the number of cheques processed. Not surprisingly, productivity growth in telecommunication carriers has skyrocketed, with output per worker increasing 6 per cent per year in the 1990s, while that in banking has been very weak (less than 1 per cent per year). A switch to measuring banking output on a transactions basis would solve at least some of the productivity paradox. The public sector is another area where a transactions-based approach to output measurement would likely reveal much greater productivity gains than those recorded in the productivity statistics.

A second strand of the mismeasurement hypothesis argues many of the benefits of IT by their very nature cannot be captured in output statistics. Examples of these types of benefits include greater customer service such as the convenience of 24 hour world-wide banking through ATMs, greater access to information through the world wide web, faster and cheaper communications through e-mail, and higher job satisfaction arising from the use of IT. According to this view, if these benefits were properly quantified, the societal welfare would be much greater that implied by our national income statistics.

There is undoubtedly truth in this. But the same argument can be made that in the past we did not fully capture the societal benefits of new goods and services as well as quality improvements in existing products. Earlier technological innovations increased productivity growth and economic welfare even without the inclusion of non-quantifiable benefits. Why cannot IT do the same?

A related argument sees IT as a strategic tool that can be used to create a competitive advantage for a firm. From this perspective, IT is introduced not to increase the size of the overall pie through productivity improvement, but to increase a particular firm's share of the pie. From the firm's point of view, the benefits of IT can be very large if IT results in an increase in market share. But from the point of view of the overall economy and society, without productivity increases, the benefits of IT are zero.

A third and final strand of the measurement issue argues that IT has in fact increased the trend or underlying productivity growth. But this favourable development has been masked by negative influences on productivity such as slow demand growth. The evidence for this position appears weak.

ii) the lag hypothesis or "the benefits of IT are coming"

The second major hypothesis advanced to explain the productivity paradox argues that IT has enormous potential to increase productivity, but certain barriers prevent the realization of this potential. Once these barriers are removed, productivity gains from IT will be substantial. To support this view of long lags in the effective implementation of new technologies, an historical analogy is often made between IT and electricity. Apparently, the slow diffusion of electricity resulted in faster productivity growth only in the1920s, 40 years after the first dynamos were introduced. As a counterargument, it is pointed out that the very large decrease in the price of computers has made their diffusion much more rapid than that of electricity, and hence reduced the basis for a lagged productivity effect.

Organizational structures poorly suited to the effective implementation of IT have been identified as one possible barrier. For example, existing organizational hierarchies and rigidities may prevent any productivity gains arising from IT at the individual level from showing up at the level of the organization. With greater access to information and means of communication provided by IT, decentralized, flatter organizational structures that give employees more control over the work process may be needed to translate the productivity-augmenting potential of IT into reality.

The effective use of IT requires a workforce able to harness IT's potential. Thus, a poorly trained workforce may constitute a second barrier to productivity improvement. The failure of many organizations to provide their employees with sufficient and appropriate IT-related training may account for the lack of productivity improvement arising from the introduction of IT.

A third barrier to effective IT use lies in usability problems that plague computers. Lack of standardization and excessive complexity often reduce the effectiveness of software programs. Without user-friendliness, the productivity-enhancing potential of IT cannot be realized.

The proponents of the lag hypothesis argue that the barriers outlined above are coming down. Organizations are becoming more flexible, the workforce is increasingly computer literate, and computer programs are becoming more user friendly. This means that the conditions necessary for the effective use of IT may soon be in place, with improved productivity growth on the horizon.

iii) the exaggerated IT benefits hypothesis or "the benefits of IT are never coming"

The third hypothesis to explain the productivity paradox is that the ability of IT to raise economy-wide productivity has been exaggerated. From this perspective, there is no productivity paradox as IT should not have been expected to result in substantial productivity improvement in the first place.

This inability of IT to raise productivity growth is based on a number of factors. First, despite its prominence in discussions of investment, IT represents only a small share of total investment in the economy. As Figure 2 shows, in 1996 business investment in office machines, valued at $6.9 billion, accounted for only 9.6 per cent of current dollar total investment. As the contribution of an input to output and productivity growth is believed proportional to its share in output, IT's small investment share suggests one should not expect any major impact on productivity.

As a counterargument, it is pointed out with declining computer prices, the constant dollar share of IT in total investment (29.5 per cent in 1996) greatly exceeds the current dollar share, suggesting a greater potential contribution to productivity. Equally, in certain sectors such as business services, trade, and finance, insurance and real estate (Table 8), IT represents a large share of current dollar total investment, and an even larger share of constant dollar investment. Yet, productivity growth in these sectors has been weak, suggesting that a paradox does exist..

A second and more fundamental reason why IT may have failed to revive productivity growth is that in many areas IT does not fundamentally alter the production process and improve productivity. For certain tasks and activities, IT indisputably raises productivity. But for many white collar and service activities it is not obvious that IT fundamentally changes the nature of the production process in a manner that increases productivity. Certain computer applications such as spread sheets, graphics and presentation programs, E-mail, and web sites may create little value, while others such as computer games like solitaire may actually be productivity sinks and reduce productivity. Equally, it is hard to make the case that computerization increases the quality of decision-making. The equation of the silicon chip with the great innovations of the past, like the stream engine, the internal combustion engine, the railway, and electricity, may be misleading. Many workplace activities may just not be amenable to productivity improvement through computerization.

A third factor behind the exaggerated IT benefits hypothesis is that the costs associated with the operation of computer systems are greatly underestimated, and these costs significantly reduce the net benefits of IT. These costs include hardware and software upgrading, technical support for computer systems, employee training and retraining, and the substitution of expensive labour and machines for cheap labour (e.g. highly-paid professionals using powerful computers to produce fancy overheads). Probably the best known example of the underestimated costs of computers is the year 2000 conversion problem, which according to one estimate, will cost $600 billion US worldwide to correct. While some argue these costs are transitional, others see them as of a permanent feature of the use of IT.

Table 8

Computer Investment and Total Factor Productivity Growth in Service Industries in Canada

	Computers as % Total Investment, 1995	% Change in Real Computer Inv. 1992-95	% Change in Total Productivity Factor 1992-95
Transportation and storage	3.4	86.8	6.8
Communications and other utilities	7.8	108.3	9.7
Wholesale	14.7	59.1	-0.6
Retail	16.5	351.4	-0.2
Finance, insurance and real estate	13.4	85.8	-0.8
Business services	55.8	3.2	-15.6
Government services	6.6	45.2	0.1
Educational services	7.3	67.0	-2.2
Health and social services	7.5	97.2	-4.6
Hotels and restaurants	5.4	3.4	4.2
Total service sector	9.8	64.2	1.2

Source: Centre for the Study of Living Standards based on Statistics Canada data

Note: Telecommunications equipment excluded.

iv) summing up of the arguments

As is the case with most economic puzzles, there is no one solution to the productivity paradox. Rather the hypotheses discussed above may all be capturing different aspects of the productivity paradox and contribute to the explanation. But it appears that a stronger case can be made for the relevance of the mismeasurement and exaggerated benefit hypotheses over the lagged benefit hypothesis.

For many tasks and activities, computers are a boon for productivity. They reduce human toil. Based on quantifiable indicators of output such as transactions processed, studies show that the introduction of computers into many sectors, such as telecommunications, banking, and public administration has, increased productivity. When these performance indicators are the basis of the output measure used to calculate productivity, as in telecommunications, the statistics show significant productivity gains. When they are not, as in banking and public administration, productivity is stagnant. Thus output mismeasurement is an important part of the productivity paradox.

But for many other task and activities, computers have limited potential to raise productivity as they do not fundamentally affect the nature of the production process. This is the case for many managerial and professional activities. The introduction of computers in these areas, while undoubtedly producing non-quantifiable benefits, does not directly increase any quantifiable indicator of output. Thus, in many areas, the potential for productivity gains from computers has been oversold, creating the allusion of a greater productivity paradox than actually exists.

The lagged benefits hypothesis explains less of the productivity paradox than the other two hypotheses. The main reason is that computers are now widely diffused. It is difficult to believe that barriers to their effective use have not yet been largely overcome, if they ever are to be overcome. A possible exception may be the role inappropriate organizational structures play in the failure of firms to realize potential IT benefits, but this factor's contribution to the productivity paradox is probably small.

v) implications of the findings

The analysis of the productivity paradox presented above has important implications for both government and business. From the point of view of public policy, the finding that output mismeasurement is an important part of the explanation of the productivity paradox suggests that a key priority must be the development of better output and performance measures and indicators, particularly for the service sector (including public administration) where measurement problems are the most severe.

From the point of view of the private sector, the finding that much of the productivity paradox has been based on an exaggeration or overselling of productivity gains from computerization should lead, in cases where the productivity effects of IT are not easily quantifiable, to tougher approval criteria for IT investment decisions.

B. The Relationship Between Employment and Productivity

It is often suggested that there is a conflict between the objectives of maximizing employment growth and increasing productivity growth. By definition, for a given output growth rate, a higher rate of labour productivity growth will be associated with a lower rate of employment growth and vice-versa, everything else being equal.

One perspective on this issue, popularized recently by Jeremy Rifkin in this best-selling book *The End of Work*, argues that technology is increasing productivity at an unprecedented rate. According to Rifkin, productivity advances are resulting in the massive destruction of jobs and the end of work. Rifkin thus believes that there is a strong negative relationship between productivity and employment. The recent experience of the United States, the world's technological leader, would appear to negate Rifkin's scenario of technology leading to mass unemployment. Despite the introduction of new technologies in all sectors, by October 1997, the US unemployment rate had fallen to 4.7 per cent, the lowest in over 20 years.

A second much more sophisticated perspective, put forward by the OECD among others, is that in the long-run there is no negative relationship between productivity and employment. This is because productivity gains raise income, which in turn increases demand and creates jobs. The rate of output growth is not predetermined. Faster productivity growth can lead to greater output growth and hence employment growth, while a failure to increase productivity may result in lower output and employment growth. According to this view, the goal of improving productivity growth and hence real income growth is not inconsistent with the objectives of faster total employment growth, although for specific sectors there may be situations where productivity advances are associated with falls in employment.

Indeed, it does not follow that if productivity growth is, say, one percentage point lower, output growth will be unchanged, and employment growth will be one percentage point higher. Lower aggregate productivity growth would have meant lower growth in real domestic income and hence lower domestic demand growth as income is the key determinant of spending. Equally, lower productivity growth, everything else held constant, would have lead to higher unit labour cost growth and hence a worsening of a country's cost competitiveness of world markets. This development would have lead to a fall in exports and an increase in imports, lowering output growth. These two offsetting factors suggest that lower productivity growth would not be consistent with a constant output growth rate and hence an increase in employment growth equal to the fall in productivity growth.[17]

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[17] It should be noted however that the relative impact of a given decline in productivity growth on output growth may be greater in industries whose output is traded internationally or which produce inputs for the traded goods sector. In these industries a failure to improve productivity in step with competitors results in increased relative costs and a decline in international competitiveness, and hence in the demand for the output of the industries and falls in employment. In contrast, in the industries which do not produce directly or indirectly for the international market, lower productivity growth may not lead to as large a fall

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A third even more sophisticated perspective, advanced by Paul Romer (1987) of Stanford University, does see some negative relationship between productivity and employment. Indeed, he argues that the contrast between a weak employment growth/ high productivity Europe and a strong employment growth/low productivity growth United States represents evidence of a tradeoff between long-term employment growth and productivity growth.

Romer argues that because of the positive externalities or spillovers associated with investment, there are increasing aggregate returns to capital. This means that the contribution of capital to growth is much higher (0.7 to 1.0) than indicated by capital's share of national income (0.3). Equally, Romer believes there may be a negative externality associated with labour. Increased labour supply may decrease the rate of growth of wages, which decreases innovation. In other words, labour surpluses impede labour-saving technical change. Thus, the contribution of labour to output may be much lower (0.1-0.3) than labour's share (0.7). Romer shows that this means an increase in the rate of growth of labour will be accompanied by a fall in labour productivity growth and feels the increased labour supply in the 1970s associated with the baby boom generation entering the labour force contributed to the productivity slowdown. He also argues that European policies of restricting total hours worked and keeping wage growth rates high may make sense from the point of view of increasing productivity.

C. The Link Between Competitiveness and Productivity

The importance for a country of achieving "international competitiveness" is widely considered a goal of public policy. Indeed, the imperatives of international competitiveness are used as a rationale for many government actions, from deficit reduction to cuts in the social safety net. International competitiveness ratings produced by such organizations as the World Economic Forum garner considerable media attention and are followed closely by government officials.

From the point of view of a firm or even a sector, international competitiveness may be a useful concept as the competitive struggle can represent a zero-sum game where the losses of one firm or sector are offset by the gains of another. But as Paul Krugman (1994, 1994a,1996)[18] has pointed out, from the point of view of a country, the usefulness of the concept of competitiveness in the sense of trade surpluses or a country beating out another country is problematic. Rather than a zero-sum game, international trade

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in demand for the output of the sector and hence in employment. The lack of foreign demand means the price elasticities for the output of these industries are lower. In other words, there is one less channel or link between productivity growth and employment growth in the non-traded goods sector since there is no possibility of losing foreign markets. Of course, lower productivity growth in this sector still results in lower real income growth and hence a lower rate of overall demand growth.

[18] To sample Krugman's many popular articles on this topic, see his website (web.mit.edu/krugman/www/).

represents a positive-sum game at the economy-wide level, as economic exchange among countries is not rivalrous.

There is a growing consensus among economists that the notion of international competitiveness must be weaned of its mercantilistic origins and associated with the concepts of rising productivity and living standards. Thus an appropriate definition of competitiveness, suggested by Landau, Taylor and Wright (1996:8) might be

> "the ability to sustain an acceptable rate of growth in the real standard of living of the population, while avoiding social costs such as high unemployment, excessive environmental damage, or extremes in inequality in the distribution of income. Furthermore, current growth must be achieved without reducing growth potential in standards of living of future generations... According the most promising way to increase the US standard of living is a healthy annual increase in the productivity of labor. Indeed, productivity is a more fundamental concept than competitiveness"

Michael Porter (1990:6), one of the gurus of the competitiveness industry, also argues that productivity trumps competitiveness as a useful economic concept at the national level, as the following quotation shows.

> "We must abandon the whole notion of a "competitive nation" as a term having much meaning for economic prosperity. The principal economic goal of a nation is to produce a high and rising standard of living for its citizens. The ability to do so depends not on the amorphous notion of "competitiveness" but on the productivity with which a nation's resources (labor and capital) are employed....*The only meaningful concept of competitiveness at the national level is national productivity*.(italics added) A rising standard of living depends on the capacity of a nation's firms to achieve high levels of productivity and to increase productivity over time."

V. Actions and Policies to Improve Productivity Growth

Research on the determinants of economic growth and productivity growth suggests that there is a three-way complementarity between physical capital, human capital, and technical progress in the growth process (Lau, 1996:90). All are necessary ingredients for improved productivity performance. The new equipment that investment puts in place requires a well trained workforce for efficient operation. Technical progress is embodied in new equipment. Trained workers can only be fully productive if they have the appropriate equipment with which to work.

This suggests a three-pronged approach to increasing productivity is needed, with implications for both private sector action and public policy. First, given the central importance of capital accumulation to economic growth, high levels of physical investment are needed. Second, extensive investment in human capital is also needed. Third, technical progress must be promoted by encouraging and facilitating R&D.

A. Private Sector Action

Given the high and growing levels of domestic and international competition that prevail in most industries in Canada, the private sector already has a major incentive to engage in productivity-enhancing activities. The three-pronged framework to productivity advance outlined above is very applicable to private-sector action. To increase productivity, the private sector must increase investment in plant and equipment, train and motivate its workforce[19], and undertake greater R&D and diffuse the resulting innovations. But Canadian business faces challenges in all three areas, as highlighted below.

- Machinery and equipment investment in Canada, as a share of GDP, has historically been well below that of most other industrial countries.

- Canadian employers devote proportionally less resources to upgrading the skills of the workforce than employers in most other industrial countries (Betcherman, 1992).

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The introduction of more appropriate organizational structures and policies is a way to motivate workers and develop high-performance workplaces which increase productivity. A recent study of the Canadian workplace (Betcherman et al., 1994:96) found that high performance workplaces are characterized by some or all of the following traits: 1) a flexible work organization where work rules and job descriptions are fluid, employees are able to use discretion to get the job done, and formal and informal hierarchies are minimized; 2) a commitment to training to deepen and broaden employees' skills; 3) increased employee involvement and participation in the operation of the organization; 4) policies to promote sharing, most obviously of the financial rewards from good performance, but also of information and privilege; 5) a work process designed to improve health and reduce stress; and 6) family-friendly policies that support employees in balancing their work and domestic responsibilities.

- The resources Canada's business sector devotes to R&D, as a share of GDP, are well below that of most industrial countries (OECD, 1995).[20]

The above deficiencies bode ill for Canada's future productivity performance. Private sector action to address these deficiencies is called for if the decline in Canada's relative labour productivity level (and hence standard of living) experienced in the 1990s is to be reversed.

B. Public Policies to Foster Productivity Growth

Private sector productivity improvement depends not only on the actions of the private sector firms but also on the public policy affecting productivity growth. These policies can be classified into two basic types-1) framework policies at the macro and micro level that create an economic climate conducive to productivity growth, including monetary and fiscal policy, trade policy, competition policy, and tax policy; and 2) policies and programs which directly affect the three-pronged determinants of private sector productivity performance, namely physical investment, human capital development, and technological change and innovation.

i) framework policies

As discussed earlier in the report, an appropriate macroeconomic and microeconomic environment is crucial if actual productivity growth is to approach potential growth. Government has responsibility for the creation of such an environment.

The high-interest rate, low growth macroeconomic environment of the first half of the 1990s greatly contributed to our extremely weak productivity performance during this period. If productivity growth is to pick-up in coming years, real interest rates must remain low to foster strong growth in aggregate demand. Appropriate macroeconomic policy is crucial in ensuring that there is no shortfall between actual and trend productivity growth as there was in the 1989-96 period. Appropriate macroeconomic policy leading to the elimination of any output gap and the maintenance of actual growth at potential would boost labour productivity growth from the average 0.6 per cent per year experienced in the 1989-96 period to the trend of around 1.5 per cent per year. The debate center around what constitutes appropriate macroeconomic policy-

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[20] Structural factors such as high levels of foreign investment and the greater importance of low R&D intensive resource industries may in part account for this low level. Many Canadian firms of course devote considerable resources to R&D, particularly in high-tech industries like communications and electronics. It should also be noted that both the share of R&D financed by business in total R&D and the overall business R&D/GDP ratio have been trending upwards in recent years.

The micro-economic policy environment for productivity growth has improved considerably in this country in recent years. Barriers to international trade have been dismantled through the FTA and NAFTA (although certain internal barriers to interprovincial trade remain); a number of industries such as telecommunications have been deregulated; governments have privatized Crown corporations; and the tax system has been made more efficient through the elimination of the Manufacturer's Sales Tax and introduction of the GST. This trend toward more market-oriented policies will continue and will improve trend productivity growth, although the impact on aggregate productivity growth is probably relatively small.

In the marketing of controversial micro-economic policy initiatives to the public, it is sometimes tempting for governments to exaggerate the importance of these initiatives for productivity growth. For example, the Department of Finance (1990: Table 4, page 54), in the 1990 budget, forecast average annual real GDP growth of 3.4 per cent for the 1990-95 period, an improvement from the rate of growth experienced in the 1980s. This forecast was based on the belief that the micro-economic policy initiatives and policies introduced by the government had raised Canada's potential growth to 3.4 per cent from 2.75 per cent in the mid-1980s. Actual output growth in the first half of the 1990s was 1.2 per cent per year and most estimates of potential growth for the period are in the 2.5-3.0 per cent range.

ii) government policies directly affecting productivity

- *physical investment*

Government corporate tax policies influence private sector capital accumulation. Lower effective tax rates in principle lead to more investment, both by producing larger post-tax profits for firms to reinvest and by attracting direct foreign investment because of the favourable tax regime. However, the potential for lower corporate taxes to generate additional investment in the Canadian economy appears limited. First, the corporate tax burden in Canada is already low from an international perspective. According to OECD (1995) figures, the burden of corporate income taxes in Canada, which represents 1.75 per cent of GDP, is about two-third the OECD average of 2.64 per cent of GDP. Second, Canada's corporate tax burden is competitive with that of our major trading partner, the United States (Iqbal, 1994).

Government is responsible for providing the physical infrastructure such as roads and airports that the private sector needs to operate efficiently. As noted earlier in the report, public investment in Canada has fallen and a number of macro-econometric studies (e.g. Aschauer, 1989; Munnell, 1990)) have found that this development lowered productivity growth. Consequently, increased public investment in infrastructure may improve aggregate productivity growth. However, a word of caution is needed. The macro-econometric evidence suggesting a positive link between public investment and aggregate productivity growth does not mean that rigorous cost-benefit analyses of any potential public investment project should not be done. Indeed, as Gramlich (1994) has stressed, only projects that meet acceptable social rates of return criteria should be undertaken.

- *human capital development*

The quality and quantity of a country's human capital is closely associated with the quality and breadth of the country's education and training system. Government of course plays a major role in funding and shaping this system.

By the criteria of expenditure and access to education, Canada's education system compares very favourably with that in other countries. According to OECD (1995) figures, public expenditure on education in Canada, as a share of GDP, is one of the highest in the OECD. Equally, Canada has the highest post-secondary enrolment rate in the OECD, even ahead of the United States.

But questions have been raised about the quality of our education system. The performance of Canadian students on international tests has been middling. A significant percentage of young Canadians do not complete high school. The number of Canadians with literacy and numeracy skills that are inadequate for meeting the rising demands of the workplace is surprisingly high. The existence of skills shortages in a number of high-technology occupations suggest post-secondary institutions are not meeting the needs of the employers by producing an adequate supply of graduates in the appropriate fields.

By addressing the above problems, among others, there may be potential for government policy to improve the already high level and quality of the human capital of Canadians and consequently contribute to productivity growth. Within the context of the debate on the fiscal dividend, a strong case can be made that education should be a priority area for any spending increases.

As part of overall fiscal retrenchment, government spending on training has been cut in the 1990s. According to OECD data, federal government spending on active labour market measures has fallen from 0.61 per cent of GDP in 1991-92 to 0.56 per cent in 1996-97 (Sharpe and Haddow, 1997b and OECD, 1997). Not surprisingly, the number of participants in federal labour market programs has fallen. Given the importance of a highly trained workforce for productivity improvement, developments in the government training area are disturbing. Again, with the end of fiscal restraint, both federal and provincial governments may wish to consider the expansion of active labour market programs as an investment in the future productivity of the labour force. Needless to say, any program that is a candidate for expansion should have a track record of success based on appropriate program evaluation criteria.

As a means of addressing a perceived private sector training gap, the federal government and a number of provincial governments in the 1990s promoted a partnership model where business and labour, with the assistance of government, work together to develop training strategies. Labour force development boards and sectoral training councils represent the institutional form of this partnership model. While labour force boards have had limited success (Sharpe and Haddow, 1997a), sector councils have flourished (Sharpe and Gunderson, forthcoming) and now exist in 28 sectors. The partnership approach to training can foster human capital development, with positive long-term effects for productivity. Governments should be encouraged to continue to support this approach.

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- *technical progress and innovation*

In a recent policy paper, the Department of Finance (1994:63) points out that

"Innovation is the driving force behind improved productivity and is thus central to economic growth and long-run job creation.... It follows that no nation can afford to leave innovation to happenstance."

While recognizing that it is business that is largely responsible for innovation, and has commercial incentives to innovate on its own, the paper argues that government must complement the private sector by filling important gaps. The federal government does this in three ways:

- direct spending on science and technology. The federal government currently spends $6 billion on science and technology, roughly 60 per cent of which is performed in 150 federal laboratories. The federal government funds close to 30 per cent of all R&D in Canada. The government has recently reviewed the cost effectiveness and relative priorities of these expenditures.

- tax incentives. Canada's system of tax incentives for innovation is the most attractive in the world, according to the Conference Board of Canada. The key ingredient is the Scientific Research and Experimental Development investment tax credit. Business receives credits currently worth over one billion dollars per year.

- diffusion of technology. A number of government programs provide business information to assist in the acquisition and implementation of technology and best practice techniques. A particularly successful program has been the Industrial Research Assistance Program (IRAP), which provides technical assistance to business.

VI. Conclusion

This report has presented a comprehensive overview of the topic of productivity, looking at productivity definitions and trends, frameworks for productivity analysis, determinants of productivity growth, key issues in the productivity literature, and actions and policies to improve productivity.

The main message of the report is that productivity growth represents the key to economic success. Only through increased productivity can there be sustained increases in real income and rising levels of economic well-being for Canadians. The implication of this basic insight is that productivity should become the organizing principle of economic policy. Indeed, the bottom line for economic policy-makers should become productivity.

This means that all aspects of economic policy, at both the macro and micro levels, should be analyzed from the perspective of productivity growth. While policies which have negative effects on productivity should not be a priori excluded if they have important equity implications, they should be closely scrutinized and their cost in terms of foregone productivity gains made explicit.

Based on the findings in the report, the key conclusion is that a pro-economic growth approach which is pro-technology, pro-investment, and pro-education is the best avenue to productivity improvement. Without strong economic growth, potential or trend productivity growth cannot be realized. This explains the weak productivity growth in the Canadian economy since 1989. Without technical progress, trend productivity growth will fall off. Without new investment in plant and equipment, advances in technology cannot be used in the production process. Without more education, the workforce will not be able to either advance the state of technology or use new equipment.

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Appendix I - Frameworks for Analyzing Productivity Growth

A. Trend and Cyclical Approaches to Productivity Behaviour

The short- to medium- term movement of productivity is determined by two influences- an underlying productivity trend and a cyclical component. Over the long term, the cyclical component is offsetting, with cyclical upturns canceling out cyclical downturns so that actual productivity growth tends to converge on trend growth. Actual productivity growth between cyclical output peaks provides an approximation of trend productivity, although average capacity utilization over the cycle may also influence the trend.

The short-term behavior of labour productivity is explained by lags in the adjustment of labour input to changes in output. If labour input adjusted simultaneously to changes in output, productivity growth would always be at trend. Lags in the adjustment of labour input, both employment and total hours worked, are due to a number of factors, including firms' unfulfilled expectations concerning demand conditions, the existence of overhead labour which is relatively invariant to output levels, and a tendency for firms to hoard skilled labour in downturns in order not to lose their investment.

For the reasons outlined above, the rate of change in output per worker tends to move in a procyclical pattern, declining below trend in downturns and rising above trend in recoveries. The rate of change in output per hour shows a slightly more dampened procyclical movement, as it is easier to adjust average weekly hours through short-time or overtime than it is to adjust employment levels. Total factor productivity, which includes the capital stock as well as labour as an input, exhibits even greater procyclical variation in movement than output per worker because of the fixity of the capital input.

The movement of labour productivity over the cycle can be divided into five stylized phases based on the stage of the cycle. These phases are end-of-expansion, early recession, late recession, recovery, and expansion.

In the end-of-expansion phase, firms become over-optimistic about their prospects. Extrapolating from the recent years of growth, they do not anticipate the end of the expansion and hire more workers than they end up needing. Consequently, productivity growth tends to fall off during this phase of the cycle from that enjoyed during the expansion.[21]

In the early recession phase of the cycle firms are hit by unexpected declines in demand, leading to falls in output. Since firms are unable to adjust labour input levels quickly, or believe that it is not desirable to do so, productivity can decline sharply.

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[21] A study for the American manufacturing sector by Gordon(1993) found that during the last six quarters of expansion firms hire 2 per cent more workers than required, and that it takes the next eight quarters for firms to completely adjust to this situation.

As the recession lengthens, the cyclical downturn in productivity is gradually eroded and even reversed. The deterioration of the financial position of firms makes layoffs necessary. Expectations are now more realistic concerning actual demand conditions. The closing down of low productivity-level firms, which, in principle, have a higher probability of failing, can increase productivity through composition effects. For these reasons, in the latter stages of long recessions, productivity growth may actually be quite strong as labour input falls faster than output.

As recovery takes hold, a cyclical rebound in productivity occurs. Again, because of uncertainty over future market conditions, firms are reluctant to take on new workers. In addition, overhead labour can now be spread over more output. Consequently, large increases in output take place without commensurate increases in employment, resulting in strong productivity gains.

The intensity of the cyclical rebound in productivity in a recovery may be inversely related to the length of the previous downturn. In a short recession, firms have little opportunity to adjust labour input to output, so productivity falls sharply. This can set up conditions for a very large cyclical rebound in productivity. In a long recession, firms have more opportunity to adjust labour input to the new demand conditions, so there is less cyclical decline in productivity. Hence, in the recovery there is less possibility of strong cyclical productivity gains.

Finally, in the expansion phase of the cycle, productivity growth approaches its trend value as firms' expectations regarding demand conditions are meet. Desired labour input is in relative balance with actual labour input.

B. The Neo-classical/Growth Accounting Methodology

The modern study of economic growth and long-run productivity growth dates from the 1950s when Solow, Abramovitz, and Jorgenson identified the basic inputs of a growing economy as labour, capital, and technology. Solow (1957) in a famous article found that technological change, not labour and capital, was responsible for most economic growth. However, he did not measure the contribution of technological change to economic growth directly, but rather as a residual after the contribution of labour and capital had been calculated. Solow characterized this residual as "a measure of our ignorance". In the Solow model, technological change was exogenous or "manna from heaven" although this treatment of technology was not meant to be taken literally but rather as an abstraction to simplify and facilitate the model's focus on long-term growth.

Solow's theoretical framework for the analysis of economic growth (Solow, 1956) served as the basis for the development by Edward Denison of a growth accounting framework that allocated economic growth into a large number of sources, including increases in the education of the labor force, the contribution of capital, the shift of resources from low-productivity endeavors into the mainstream of the modern economy, gains from knowledge, and economics of scale.

Denison first applied this framework to the US economy in his 1962 landmark study *The Sources of Economic Growth in the United States and the Alternatives Before Us*. Later growth accounting studies provided updates for the United States (Denison, 1974, 1979, 1985) and applied the growth accounting methodology to other countries (Denison, 1967), including Canada (Walters, 1968).

One major difference between the frameworks developed by Solow and Denison was in the treatment of labour. Solow's model makes no adjustment to labour input for improvements in quality while Denison adjusted labour input for this factor. This meant that growth in inputs accounted for a smaller proportion of economic growth (and productivity growth a corresponding greater proportion) in the Solow model than in Denison's growth accounting framework since quality-adjusted labour input grows at a faster rate than unadjusted labour input.[22]

In the 1980s, the inability of the growth accounting framework to explain the post-1973 productivity slowdown (Denison called the slowdown a "mystery") raised serious questions about its usefulness. Consequently, in the past decade growth accounting in the Denison fashion has fallen out of favour.

C. Knowledge-based Growth Approach to Economic and Productivity Growth

Economic theory advances in stages. First a simple framework based on highly restrictive and often unrealistic assumptions is developed. Then over time, these assumptions are gradually eliminated as the model attempts to incorporate more elements of reality. The development of the theory of economic growth from the 1950s to the 1990s has conformed to this pattern.

The limitations of the neoclassical or Solow growth model and growth accounting methodology as an explanation of the growth process has in recent years lead to the development of more sophisticated and realistic models of economic growth by such economists as Paul Romer.[23] A key feature of many of these models is the emphasis on knowledge as the driving force behind productivity growth.

Romer (1990) has pointed out

"the neoclassical assumptions of diminishing returns to increasing investment and perfect competition placed the accumulation of new technologies at the centre of the growth process and simultaneously denied the possibility that economic analysis could have anything to say about this process"

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[22] Jorgenson (1996:10) indeed argues that Denison's lasting contribution was to quantify the role of improvements in the quality of the workforce due to high levels of educational attainment.

[23] The seminal article is Romer (1986). Also see Romer (1987, 1990, and 1994). For a complete listing of Romer's publications (as well as some of the actual publications), see Romer's personal website (www-leland.stanford.edu/~promer/).

In other words, while early versions of growth theory convincingly demonstrated the importance of studying technology, the aggregate macroeconomic models used offered little room for the analysis of the sources of invention or innovation, new and improved products or processes, or organizational or structural change (Landau, Taylor and Wright, 1996).

In recent years, the basic neoclassical model has been enriched and expanded upon in at least five broad areas (Landau, Taylor and Wright, 1996). These developments, some of which are discussed briefly below, reflect the elimination of many of the model's restrictive and unrealistic assumptions.

- Neoclassical growth theory assumed that all firms behaved in the same manner in their quest to maximize profits. It is now widely recognized that while the profit motive is still important, behaviour can differ greatly among firms. Economists interested in economic growth are now exploring such questions as how firms learn from experience, how good management differs from bad management, how firms differ in gathering and transmitting information internally, and how firms compete in international markets. Two of the leaders in investigating these questions have been Michael Porter in his 1990 study *The Competitive Advantage of Nations* and Alfred Chandler (1992)

- The neoclassical model also assumed perfect competition. This is a particularly unrealistic assumption for a growth model because in a world characterized by perfect competition firms have no incentive to undertake research and development since they can sell at the market price all they can produce. Such a model also assumes away the important real-world issue of the appropriability of the gains from technical progress. Many models of economic growth now assume monopolistic competition (Helpman) and give explicit treatment to patents as a mechanism for influencing the appropriability of the gains from technical progress (Griliches, 1994).

- The neoclassical model assumes that the secrets of technical progress are available to all. This implies that productivity levels in all countries will converge on that of the technological leader as these countries avail themselves to this knowledge. But this ignores the obvious point that the social capability to gain advantage of advanced technologies varies greatly among nations and explains why productivity levels have not converged. Putman (1993) has developed the concept of "social capital" as a factor of production to explain international difference in growth rates and productivity levels.

- In the neoclassical model, all industries are assumed equally important. But some economists now argue that certain industries may be more important to long-run productivity growth than others because they yield a greater rate of social return through externalities (e.g. the information technology sector), may exhibit increasing returns to scale, or may make disproportionate contributions to exports, investment or job creation.

- An implication of the early growth theory was that the long-term steady-state rate of growth was determined by the rate of technical progress and population growth and was independent of the rate of saving and investment. Recent research suggests that the higher rates of accumulation and investment can increase productivity growth; that there is no steady-state rate of growth; and that there is interdependence between the inputs in the growth process. For example, Boskin and Lau (1992) found that the higher the capital stock, the more technology can increase productivity.

Appendix II - Additional Issues in the Productivity Literature

A. The Post-1973 Productivity Slowdown

The most important productivity development in the postwar period, affecting labour and total factor productivity in almost all sectors in Canada (Table 1) and in other industrial countries (Table 2), has been the post-1973 slowdown in productivity growth.[24]

Assar Lindbeck (1991) has put forward five broad categories of explanations of the slowdown. The first explanation is that the slowdown is a statistical artifact. Current evidence heavily weights against this explanation, although it may be important in certain sectors. One reason this explanation is unconvincing is that it must be shown that measurement errors have grown more serious after 1973, not just that they exist.

A second explanation of the slowdown is that it reflects the unavoidable, gradual erosion of some uniquely favorable factors which spurred productivity growth after World War Two. According to this perspective, it is the rapid productivity growth in the 30 years following World War Two that needs explanation, not the return to long-run trend productivity growth after 1973.

Factors often cited as accounting for the postwar boom in productivity growth include the sectoral reallocation of labour from low productivity activities such as agriculture to high productivity activities; large technological catch-up possibilities due to weak private sector investment during the depression and W.W.II; trade liberalization; and the depletion of the productivity-augmenting potential of dominant mass production technologies.

A third explanation is the deterioration in the economic environment that surrounds firms, and the deterioration of general economic mechanisms and incentives in society. It is postulated that the growth of the welfare state, higher tax rates, and increased government regulation have had a negative effect on productivity growth. A major weakness of this explanation is that the exact linkages and timing between these developments and poorer productivity performance are seldom well specified.

A fourth explanation of the slowdown is the deterioration in effectiveness of the internal organization of firms. Organizational structures based on traditional principles of hierarchy and control may no longer be congruent with the requirements of new technologies and changing worker preferences.

Finally, the productivity slowdown may have been caused by macro-economic shocks, such as commodity price increases, particularly oil prices, increased inflation, and restrictive macro-economic policy. While this explanation may account for developments in the 1970s

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[24] The literature on the topic is vast. A very useful reference is a OECD volume entitled Technology and Productivity (OECD,1991), which contains nearly 40 papers by a wide variety of productivity experts.

and the 1990s it appears less relevant to explain slow productivity growth in the 1980s when shocks were less frequent and severe.

After nearly 20 years of debate, there is still no consensus among economists on the causes of the productivity slowdown. The view that appears to be gaining the largest number of adherents is the second, namely the withering away of the favourable productivity-enhancing factors of the immediate postwar period. The productivity experience in the post-1973 period in North America can be seen as a return to the long-run historical trend of around one and one half per cent per year. It should be noted that such an explanation does not imply that there has necessarily been a falloff in the underlying rate of advance of technical change. Other factors may be considerably more important in explaining the slowdown.

B. Productivity Convergence

The United States has been the world technological leader in the postwar period, with the highest level of productivity among industrial countries. But on the other hand, it has experienced the slowest productivity growth. Economists believe this is not an accidental situation, but rather reflects the dynamics of international productivity growth.

Through technological catch-up, low-productivity level countries have the potential of enjoying rapid (although declining) productivity growth until their productivity levels begin to converge on that of the leader. Indeed, a number of countries in the developed world have effectively exploited this potential in the postwar period. Table 7 shows that the average labour productivity level of 15 advanced countries rose from 43 per cent of the U.S. level in 1950 to 79 per cent in 1987.

Table 7

Average Relative Labour Productivity Level in 15 Advanced Countries
(United States =100)

1870	62
1913	54
1938	50
1950	43
1960	49
1973	66
1987	79

Source: Maddison, 1991, Table C-11.

The convergence hypothesis is based on four advantages productivity laggards may exploit (Abramovitz and David, 1996). First, these countries can make use of state of the art technology produced by the technological leader. Second, because these countries have low capital-labour ratios, the marginal product of capital is high. Third, less developed countries have considerable opportunities to shift resources out of low-productivity activities. Fourth, these countries can benefit from economies of scale as their markets grow.

But there is no automatic mechanism whereby the productivity levels of poor countries converge on that of the leader. Indeed, outside the industrial countries, there has been little convergence toward US productivity levels, with the important exception of a number of countries in East Asia. Persistent differences in national characteristics can inhibit laggard countries from exploiting the advantages of backwardness. These include poverty of natural resources; small domestic markets; barriers to trade; forms of economic organization or systems of taxation that reduce rewards to effort, enterprise or investment; or deeper elements of national culture that limit responses of people to economic opportunities. Throughout the Third World, deep-rooted political constraints imposed on social capability have prevented convergence. But when these constraints are removed, as has happened in East Asia, the potential for convergence can be realized.

C. Service Sector Productivity Measurement

In recent years, the issue of service sector measurement has received increasing attention (Griliches, 1992; Diewert, Nakamura, and Sharpe, forthcoming).[25] This is because, as noted earlier in the report, productivity growth in the service sector has been well below that in the goods sector. Indeed, some argue that lagging service sector productivity, and the rising importance of the service sector in the economy, represent an increasing drag on aggregate productivity growth.

One explanation of slower service sector productivity growth may be the greater inherent difficulty of increasing productivity in service industries. A second possibility is that official measures of service sector output may have a serious downward bias, greater than in the goods sector.[26] Indeed, if properly measured, productivity growth in the service sector may in fact not be inferior to that of the goods sector.

Reasons why it may be harder to increase productivity in service activities than in good industries may include: the more limited possibilities of mechanizing associated with the non-tangible nature of services and the one-to-one personal nature of many service activities such as health care where output depends on the interaction with the user making standardization difficult.

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[25] On the issue of output measurement in the service sector, see the papers in Griliches (1992) and the papers presented at the April 1997 CSLS conference on service sector productivity and the productivity paradox posted at CSLS website www.csls.ca and forthcoming in Diewert, Nakamura, and Sharpe.

[26] A third explanation, put forward by van Biema and Greenwald (1997) is that management in service sector firms is less able to implement productvity-enhancing innovations than management in goods sector firms.

Specific problems in the measurement of real output and hence productivity in service industries include the absence of marketed output and hence transactions in the non-business sector; conceptual difficulties in the definition of output in sectors such as banking and insurance; improvements or deterioration in quality of output which are not captured by the price indices; absence of appropriate service sector data for productivity measurement (data coverage is much better for goods industries); difficulties incorporating completely new services into existing price indices; and the extreme heterogeneity of transactions in certain service industries such as legal and health services which makes price systems non-linear and not directly linked to what is received by the customer.

Measurement problems, particularly service sector measurement problems, are often cited as an explanation of the productivity slowdown (Baily and Gordon, 1988) and the productivity paradox (Diewert and Fox, 1997).

In the discussion of measurement problems in the context of the productivity slowdown, an important distinction should be made between problems which have always existed and problems that have gotten worse after 1973. A second distinction is between problems that lead to the underestimation of real output in a particular sector, but have no effect on output at the aggregate level because of increased output in other sectors and sector-specific problems that do have an effect at the aggregate level as there are no offsetting effects on other sectors. To make a case for measurement problems as an explanation of the post-1973 productivity slowdown, it must be shown that measurement problems not only exist, but became more severe after 1973, and that underestimation of output in particular sectors is not compensated by increased output in other sectors.

A very important recent contribution to the measurement debate has been the Senate Report on the CPI, known as the Boskin report, released in December1996. This report estimated that the bias for the US CPI was within a range of 0.7-1.5 per cent and gave a point estimate of 1.1 per cent. This translates into a downward bias for aggregate US productivity growth of 0.9 per cent per year since 1977 (Data Resources Inc., 1997). Unfortunately, the data are not available to make pre-1977 estimates of the effect so the contribution of CPI bias to the productivity slowdown cannot be calculated.

D. Real Wage and Productivity

There is a common perception that real wage growth in Canada in recent years has considerably lagged productivity growth. Indeed, when the real wage is defined as nominal or money wages deflated by the Consumer Price Index, this in fact has been the case. Real consumer wages advanced only 0.3 percent per year between 1981 and 1996, compared to 0.9 percent for labour productivity.

However, a second definition or concept of real wages, less prevalent in public debate, shows a different picture. This concept is money wages deflated by the gross domestic product or total output at factor cost deflator, and represents the relative cost of labour to the producer.

According to economic theory, in competitive markets the producer real wage, defined as the money wage deflated by the producer price, will equal the marginal product of labour. Over time the producer real wage will grow at the rate of growth of average labour productivity. Labour productivity growth depends on improvements in the efficiency of production (organizational improvement, better techniques of production and skills upgrading) and growth in the capital intensity of production (the capital-labour ratio). In the long run competition ensures that the rate of return on capital is constant and therefore the growth in capital-intensity becomes due to improvements in the efficiency of production. Long-run productivity growth arises only from increases in the efficiency of production and the benefits of technical progress accrue to workers through increases in the producer real wage. This means that over long periods the rate of growth of labour productivity and the producer real wage should converge. Over short periods this will not be the case due to the influence of cyclical factors on both wages and productivity.

From the point of view of workers it is consumer prices that determines their real wage, not producer prices. There is no a priori reason that consumer prices and producer prices should increase at the same rate, even over long periods. This is because certain components of output are not consumed by consumers and hence do not directly enter into consumer prices and the rate of increase in the prices of these components of output may differ from that of consumer prices. Exports and government output are not part of consumption and investment enters into consumption only indirectly. Hence export prices, the prices of government expenditure on current goods and services, and the prices of investment goods do not directly affect the Consumer Price Index.

A second reason why consumer and producer prices may differ, which is closely linked to the first reason, is that changes in indirect taxes can have different overall effects on consumer and producer prices.

Between the 1989 and 1996 cyclical peaks nominal or money wages, defined as total economy labour compensation per hour, advanced at a 2.5 percent average annual rate (Table 9). Consumer prices, as represented by the Consumer Price Index (CPI) also rose 2.5 percent per year. Real consumer wages, defined as nominal wages deflated by the CPI were unchanged. Producer prices, as defined by the deflator for Gross Domestic Product at factor cost (i.e. excluding indirect taxes less subsidies) rose 1.7 per cent per year. Real producer wages, defined as nominal wage deflator by the GDP at factor cost deflator, thus advanced 0.8 percent per year. Labour productivity, as defined by output per hour, rose 0.5 percent per year.

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Table 9

Real Wages and Productivity Trends in the Total Economy, 1961-96
(average annual rate of change)

	1961-73	1973-81	1981-89	89-96
money wage	7.78	11.44	5.87	2.53
consumer prices	3.47	9.70	5.29	2.51
producer prices	4.03	9.83	4.28	1.68
consumer real wage	4.16	1.58	0.56	0.02
producer real wage	3.60	1.47	1.53	0.83
output per hour	3.51	1.09	1.23	0.49

Note: Real wages are measured on an hourly basis.
Source: Aggregate Productivity Measures printout, Statistics Canada, April, 1997.

The key real wage development in the 1980s and 1990s has been the reversal of the situation of the two previous decades when real consumer wage growth exceeded real producer wage growth. Money wage growth is the same for both real wage measures. This development thus reflected a reversal of the ranking of the rates of increase of consumer and producer prices. In the 1960s and 1970s producer prices rose faster than consumer prices. In the 1980s and 1990s it was the opposite. An examination of the factors behind the slower rate of advance in producer prices is thus needed to explain the slower rate of growth of consumer real wages.

The components of Consumer Price Index and the GDP deflator at factor cost are not the same so divergent trends in these components will lead to deviations in the rates of increase of the two price indices. The GDP deflator is a much broader price index and includes investment goods, exports, government output and consumer goods and services, while the CPI covers only consumer goods and services, including imported consumer products. Indirect taxes also tend to be borne largely by consumers so have a greater impact on the CPI than the overall GDP deflator. An examination of the growth rates of the various components of the GDP deflator relative to the CPI can thus explain differences in the growth rates of the two indices (Sharpe, 1994).

The slower rate of increase in the deflator for investment goods was due to the very low rate of increase for the machinery and equipment deflator (0.5 percent per year), with the ratio of consumer prices to machinery and equipment prices increasing dramatically. This in turn reflected the absolute declines in the price index for office machines because of the considerable quality improvements.

The ratio of net indirect taxes to GDP at factor cost rose from 10.2 percent in 1981 to 11.7 in 1989 to 12.3 in 1995. Net indirect taxes have a greater impact on the CPI than the GDP deflator and thus account for some of the positive differential between rates of increase of the CPI and GDP at factor cost deflator.

Growth in real consumer wages have significantly lagged productivity growth in Canada in the 1980s and 1990s. But this finding reflects a growing divergence between rates of increase in consumer and producer prices, not any fundamental breakdown in the relationship between wages and productivity. Indeed, the real producer wage, the wage which theory suggests should closely reflect productivity trends, in fact rose at about the same rate as labour productivity. This explains why labour's share of GDP only decreased slightly between 1981 and 1989, and has been stable in the 1990s despite the increasing gap between productivity and real consumer wage growth. Trends in labour's share of GDP are more closely associated with the producer wage/productivity relationship than with the consumer wage/productivity relationship. Indeed, there is no one-to-one relationship between changes in real consumer wages and profits. The faster rate of increase in consumer prices was due to well below average rates of increase in investment goods prices and increased indirect taxes.

E. The Contribution of Productivity Growth to the East Asia Miracle: Capital Accumulation versus Technical Progress

Over the past two decades, the countries of East Asia have experienced very rapid output growth and growth in labour productivity. But perhaps surprisingly, the source of this growth has not been increased technical progress as is the case in developed countries, but rapid capital accumulation. Total factor productivity has been weak in these countries. Indeed, according to Lawrence Lau of Stanford University (1996), based on the standard neo-classical approach to the sources of growth, the hypothesis that the East Asia countries have experienced no technical progress cannot be rejected.

This growth experience of the East Asia countries is actually quite similar to that of the United States in the late 19th century and early 20th century, where increases in labour and especially capital accounted for economic growth. Capital accumulation, not technical progress, appears to be the most important source of growth at initial phases of economic development. Lau (1996:89) explains this situation as follows:

"At the prevailing levels of physical capital and human capital [in East Asia], it has not yet become profitable for the developing countries to invest in R&D and other technical progress-creating activities. In time, with diminishing marginal productivity of physical capital and the increases in inputs complementary to technical progress (physical and human capital), the attractiveness of technical progress will increase relative to traditional investment in physical capital. In this sense too, technical progress can also be said to be endogenous at the level of the aggregate economy"

But what accounts for the rapid capital accumulation in the East Asia countries? In particular, what role has the State played in this growth process? Rodrik (1997) argues that high-quality institutions are critical for growth, and that "making the transition from a low-investment economy to a high-investment economy requires hands-on government". He developed an index of "institutional quality" based on quality of the bureaucracy, rule of law, risk of expropriation, and repudiation of contracts by government and finds this index, when combined with initial education and income, can explain differences in growth among East Asia countries.[27]

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[27] Other quantitative studies of the economic growth support Rodrik's findings. Based on an econometric analysis of potential growth determinants in 80 countries, Barro finds that high levels of secondary schooling, high life expectancy (reflecting good health), and a greater degree of rule of law are conducive to economic growth, while high fertility, high government expenditure (other than on education and defense), and very high inflation rates have a negative impact on growth. Barro is only able to account for one half of the variation in growth rates across countries and there are many exceptions to his general conclusions.

Appendix III - Statistical and Conceptual Issues in Productivity Measurement

Labour Input Estimates

Employment

- weaknesses in establishment surveys of employment - double counting of multiple job holders; incomplete coverage by industry, class of worker, or occupation; breaks in time series due to changes in the survey, sample frame, or SIC classifications;

- deficiencies in household surveys of employment - inaccurate responses for industry of employment, particularly if respondent reporting for other household members; underreporting of employment activity because of respondent concern over unemployment insurance, welfare, income tax, or immigration matters; inadequate sample size for reliable employment estimate at detailed industry level or by region; breaks in the time series due to changes in the survey, sample frame, or SIC classification;

- changes in the average quality of employment due, for example, to changes in average educational attainment, workforce experience, gender, or other factors.

- treatment of the impact of the re-allocation of labour on aggregate gross output;

Average weekly hours

- divergences between total paid hours and total hours at work or actually working due to longer vacations and leaves, more statutory holidays, more frequent and/or longer breaks, more formal training programs;

- changes in the intensity of worker effort due to cyclical influences, changes in the length of the work day, external considerations such as the rate of unemployment, organizational changes, or other factors affecting worker motivation.

Current Dollar Capital Stock Estimates

- deficiencies in investment intention surveys - allocation of investment to sector of ownership, not use;

- deficiencies in the collection of information on inventories;

- reliability of depreciation pattern assumptions for the perpetual inventory methodology used to estimate the capital stock - straight line, geometric, or delayed (which produce net capital stock estimates) or constant capital services throughout service life (gross capital stock estimates);

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- reliability of capital stock service life estimates, especially following output or price stocks or major technological advances;

- appropriate cyclical adjustment of capital services;

- appropriate aggregation of the capital stock - aggregation in accordance with the economic theory of production or direct aggregation;

- question of the addition of the services of the public sector capital stock (transportation infrastructure, sewers, educational facilities, etc.) to capital services used by the private sector in production;

- question of inclusion of services from a research and development capital stock in capital services used in production.

Current Dollar Intermediate Goods

- inadequate information on purchases of intermediate goods by certain industries, particularly service sector industries

Current Dollar Gross Output

- deficiencies in industry surveys or censuses of nominal output due to incomplete industry coverage, under-reporting of sales, or breaks in series due to changes in SIC classifications, survey questions or sample frame;

- appropriate output universe for productivity measurement - treatment of government sector, household sector, non-profit education and health, owner occupied dwellings, natural resource royalties, illegal activities;

- use of wages or labour input as a measure of output;

- conceptual difficulties in the definition of output;

- treatment of depreciation and taxes in the measurement of output at the industry level;

- treatment of negative outputs such as pollution and waste in estimation of nominal output.

Product Price Indices

- deficiencies in collection of product price data;
- treatment of quality changes in existing products associated with comfort, convenience, environmental factors, and utility;
- treatment of new capital and consumer products
- capture of differences between listed and actual prices, due to discounts, rebates, changes in effective fare structures;
- effect of price controls on price indices;
- sensitivity of the deflation process to index number and base year considerations;
- treatment of the effect of taxes and subsidies on product prices;
- appropriate weighting of differently priced imported and domestic goods for product prices.

APPENDIX TABLES

Table A1: Trends in Aggregate Labour Productivity Growth in Canada
(annual or average annual percent change)

	GDP per person employed	GDP per person hour	Business sector output per person employed	Business sector output per person hour
1973	3.23	3.28	3.58	3.51
1974	-1.05	-0.40	-1.45	-0.76
1975	-1.19	-0.38	-1.03	-0.42
1976	4.05	4.78	5.16	6.01
1977	0.51	2.29	0.96	2.50
1978	0.18	-0.54	0.27	-0.15
1979	0.23	0.93	0.17	0.72
1980	-0.53	0.06	-0.47	0.28
1981	1.01	2.01	1.22	2.11
1982	-2.25	-0.71	-2.59	-0.85
1983	2.45	2.96	3.59	4.13
1984	3.72	3.20	4.31	3.55
1985	0.83	0.55	0.87	0.52
1986	1.11	1.22	1.49	1.53
1987	1.54	1.05	1.69	1.10
1988	0.87	0.50	1.01	0.82
1989	0.22	1.02	0.18	0.92
1990	-1.64	-1.29	-1.73	-1.57
1991	-0.46	0.72	-0.15	1.11
1992	1.15	1.34	1.45	1.65
1993	1.03	0.78	1.58	1.00
1994	2.17	1.21	2.79	1.81
1995	0.34	0.20	0.27	0.49
1996	0.22	0.50	011	0.34
1946-61			3 45	4.27
1961-73	2.78	3.48	3.30	3.98
1973-81	0.39	1.08	0.55	1.27
1946-81			2.74	3.48
1961-81	1.82	2.51	2.20	2.89
1981 -89	1.05	1.22	1.30	1.45
1989-96	0.40	0.49	0.61	0.68
1981 -96	0.74	0.88	0.58	1.09

Source: Statistics Canada

Table A2:

Trends in Output per Hour by Detailed Industry In Canada 1984-95

	% Average compound growth rates		
	1984-89	1989-95	1984-95
Agriculture	3.06	2.61	2.82
Fishing and trapping	2.40	2.08	2.22
Logging and forestry	3.25	-5.15	-1 42
Mining, quarries and oil wells	0.60	4.56	2.74
Mining	-0.28	5.88	3.03
Metal mines	-2.04	6.79	2.68
Non-metal mines	4.78	0.20	2.25
Coal mines	5.54	7.25	6 47
Crude petroleum and natural gas	4.37	0.99	2.52
Quarry and sandpit industries	2.21	-5.80	-2.24
Services related to mineral extraction	-7.02	5.09	-0.60
Manufacturing	0.80	2.59	1.77
Food	-0.60	2.24	0.94
Meat and poultry products	-5.46	2.82	-1.03
Fish Products	-0.23	5.34	2.77
Fruit and Vegetable	21.82	-2.40	7.95
Dairy products	3.55	-1.33	0.86
Vegetable oil mills	10.79	8.98	9.80
Beverage Industries	-0.43	3 32	1.60
Soft drink industry	4.64	3.26	3.88
Distillery products industry	1.59	-2.18	-0.49
Brewery products industry	-5.41	4.19	-0.29
Wine industry	3.08	10.79	7.21
Tobacco products industry	-9.19	3.11	-2.68
Rubber products industry	0.51	11.47	6.35
Plastic products industry	-1.25	1.47	0.22
Foamed and expanded plastic products	7.10	2.78	4.72
Plastic pipe and pipe fittings industry	-1.10	-1.05	-1.07
Plastic film and sheeting industry	6.31	-5.46	-0.28
Leather and allied products industry	0.42	2.00	1.28
Primary textile and textile products	-2.05	4.03	1.22
Broad knitted fabric industry	6.01	15.89	11.29
Carpet, mat and rug industry	5.39	-6.62	-1.34
Clothing industries	1.14	0.15	0.60
Men's and boy's clothing industries	0.41	1.46	0.98
Women's clothing industries	8 58	-5.67	0.56
Children's clothing industries	-3.12	12.18	4.95
Wood Industries	0.98	-1.48	-0.37
Sawmills, planing and shingle mills	4.11	-0.94	1.33
Veneer and plywood industries	1.57	1.68	1.63

Source: Centre for the Study of Living Standards; based on Statistics Canada Labour Force Survey and GDP data, July 1997

Table A2:

Trends in Output per Hour by Detailed Industry In Canada 1984-95

	% Average compound growth rates		
	1984-89	1989-95	1984-95
Sash, door, millworks	-4.29	-4.30	-4.29
Furniture and fixtures	-0.89	3.31	1.38
Household furniture	-1.06	2.50	0.86
Office furniture	-2.13	2.14	0.18
Other furniture and fixtures	-2.03	0.69	-0.55
Paper and allied products	-2.60	2.97	0.40
Pulp and paper mills	-2.83	2.76	0.18
Asphalt roofing .	12.11	-2.25	4.03
Paper box and bag	-5.67	6.28	0.67
Other converted paper products	-0.08	-0.07	-0.08
Printing, publishing and allied industries	-0.79	-4.13	-2.63
Publishing	0.97	-6.59	-3.23
Primary metal industries	0.15	5.31	2.93
Primary steel industries	-3.80	4.20	0.49
Steel pipe and tube industries	4.67	8.14	6.55
Iron foundries	-1.68	-0.27	-0.91
Non ferrous steel smelting	4.23	7.96	6.25
Aluminum rolling casting	20.07	-5.92	5.11
Copper rolling casting	-4.53	4.08	0.07
Fabricated metal products	2.12	-0.37	0.75
Ornamental end archmetal products	9.25	-4.40	1.58
Stamped, pressed and coated metal products	1.72	2.02	1.88
Wire and wire products	-2.17	4.89	1.62
Hardware, tool and cutlery	4.34	1.25	2.64
Heating equipment	10.06	-6.43	0.73
Machine shops	-4.18	2.66	-0.51
Other metal fabricated products	-2.19	0.59	-0.58
Machinery industries	2.14	-0.18	0.87
Agricultural implements	9.85	1.84	5.40
Commercial refrigeration equipment	-11.45	15 90	2.55
Other machinery and equipment	2.06	-1.65	0.02
Transportation equipment	0.33	2.18	1.34
Aircraft and aircraft parts	1.67	-0.71	0.37
Motor vehicles	0.75	3.08	2.01
Truck, bus body and trailers	-0.58	-4.40	-2.69
Motor vehicle parts and accessories	-0.49	2.70	1.24
Railroad rolling stock	2.72	-1.90	0.18
Shipbuilding and repaid	-3.57	-2.57	-3.03
Electrical and electrical products	7.59	11.45	9.68
Small electrical appliances	-7.97	18.41	5.59
Major appliances	-3.24	7.89	2.68
Record players radios. TV recorders	4.32	8.51	6.58
Commercial and other electronic equipment	11.30	2.75	6.55
Office, store and business machines	17.47	29.85	24.07

Source: Centre for the Study of Living Standards based on Statistics Canada Labour Force Survey and GDP data, July 1997

Table A2:

Trends in Output per Hour by Detailed Industry In Canada 1984-95

	% Average compound growth rates 1984-89	1989-95	1984-95
Electrical industrial equipment	5.79	-2.39	1.24
Non-metallic mineral products	3.69	-3.55	-0.33
Clay products	2.04	-6.03	-2.45
Cement	12.36	-4.78	2.66
Concrete products	7.32	-7.22	-0.87
Ready mix concrete	12.74	-10.05	-0.33
Glass and glass products	-6.54	0.30	-2.87
Refined petroleum and coal products	0.71	11.01	6.21
Chemical end chemical products	0.55	1.96	1.32
Plastics and synthetic resins	8.80	14.40	11.82
Pharmaceuticals	-1.71	0.63	-0.44
Paint and varnish	-1.53	1.15	4.08
Soap and cleaning compounds	-1.01	-5.70	-3.60
Toilet preparations	7.07	-7.93	-1.40
Other manufacturing industries	-0.38	0.91	0.32
Jewelry and precious metals	13.38	-5.71	2.53
Sporting goods and toys	-6.17	3.08	-1.23
Signs and displays	-6.39	0.17	-2.87
Construction	-2.31	0.18	-0.96
Transportation and storage	0.66	0.42	0.53
Transportation	0.23	-0.26	-0.04
Air transport and related services	-5.02	-4.12	-4.53
Railway transport and related services	5.49	8.30	7.02
Water transport and related services	0.20	-2.22	-1.13
Truck transport	-0.56	0.07	-0.22
Storage and warehousing	-1.28	-5.93	-3.85
Communication	1.73	5.61	3.83
Telecommunication broadcasting	-6.23	4.97	-0.28
Telecommunication carriers	5.45	6.09	5.80
Postal service	-1.82	0.66	-0.48
Other Utilities	-0.69	1.47	0.49
Electric power systems	-0.50	3.15	1.48
Gas distribution systems	-1.04	0.53	-0.19
Other utilities n.e.c.	4.83	-4.03	-0.10
Trade	2.28	2.00	2.13
Wholesale trade	3.63	2 70	3.13
Retail trade	0.93	1.13	1.04

Source: Centre for the Study of Living Standards based on Statistics Canada Labour Force Survey and GDP data, July 1997

Table A2:

Trends in Output per Hour by Detailed Industry In Canada 1984-95

	% Average compound growth rates 1984-89	1989-95	1984-95
Finance, insurance and real estate (FIRE)*	0.56	-0.20	0.15
Finance and real estate	0.21	-0.14	0.02
Banks, credit unions and other	2.03	1.60	1.80
Banks and other deposit accepting institutions	1.60	1.93	1.78
Credit unions	4.35	-0.14	1.88
Trust, other finance and real estate companies	-0.88	-0.76	-0.82
Insurance	6.07	-0.80	2.26
Commercial, business and personal services	-0.49	-0.87	-0.70
Business services	-0.14	-1.14	-0.69
Computer and related	-0.79	-0.46	-0.61
Advertising Services	-6.15	-6.81	-6.51
Education and related services	-1.89	-0.60	-1.19
Health services	-0.45	-1.04	-0.77
Hospitals	1.07	-0.39	0.27
Accommodation, food and beverage	-1.70	-1.92	-1.82
Accommodation	-2.02	2.11	0.21
Food and beverage	-1.39	-3.58	-2.59
Amusement and recreation services	0.05	-1.35	-0.72
Motion picture and video production and distribution	-1.65	-3.93	-2.90
Motion picture exhibition	12.56	12.19	12.36
Personal. household and others	3.02	-0.51	1.08
Laundries and cleaners	-3.91	0.35	-1.61
Government services	-0.92	1.88	0.60
Federa!	-1.05	2.00	0.60
Provincial	1.24	1.72	1.50
Local	2.26	2.48	2.38
Total Economy	0.42	1.19	0.84
Total economy minus (govemment services and imputations)	**0.48**	**0.93**	**0.72**
Goods producing industries	0.53	2.23	1.45
Services producing industries	0.41	0.76	0.60

Source: Centre for the Study of Living Standards based on Statistics Canada Labour Force Survey and GDP data, July 1997

Table A3:

Trends in Capital Productivity by Detailed Industry In Canada 1984-95

	% Average compound growth rates 1984-89	1989-95	1984-95
Agriculture	8.66	5.46	6.90
Fishing and Trapping	4.68	-3.98	-0.13
Logging	3.78	-1.38	0.93
Mining, quarries end oil wells	4.93	3.60	4.21
Mining	6.32	6.01	6.15
Metal mines	3.15	3.87	3.54
Non-metal mines	5.18	10.67	8.14
Coal mines	16.59	12.39	14.28
Crude petroleum and natural gas industries	5.92	3.22	4.44
Quarry, sandpit and service industries	9.95	-5.22	1.40
Manufacturing	-2.15	2.09	0.14
Food	-2.80	1.64	-0.40
Beverage	0.75	2.17	1.52
Tobacco	-3.23	-3.51	-3.38
Rubber products	-5.96	9.00	1.92
Plastic products	-7.09	-0.63	-3.62
Leather products	-4.27	-4.78	-4.55
Primary textiles and textile products	-0.34	0.86	0.32
Clothing	-2.54	-5.09	-3.94
Wood	-0.64	-2.19	-1.49
Furniture and fixture	-3.66	-0.19	-1.78
Paper and allied products	-10.15	1.48	-3.98
Printing, publishing and ailiec industries	-3.90	-8.47	-6.42
Primary metal industries	-2.22	4.20	1.23
Fabricated metal products	1.04	2.63	1.91
Machinery	2.14	-3.14	-0.77
Transportation equipment	-8.93	1.12	-3.58
Electrical and electronic products	2.13	10.50	6.62
Non-metallic mineral products	0.99	3.27	2.22
Refined petroleum and coal products	4.07	6.49	5.39
Chemical and chemical products	2.29	2.66	2.49
Other manufacturing	-8.07	-3.46	-5.58
Construction	0.08	-3.61	-1.95
Transportation, storage. communications and other utilities	2.04	-0.22	0.80
Transportation and storage	3.15	0.05	1.44
Transportation	2.05	1.30	1.64
Air transport and related services	-6.92	-5.36	-6.07

Source: Centre tor the Study of Living Standards based on Statistics Canada GDP and Capital Stock data, July 1997

Table A3:

Trends in Capital Productivity by Detailed Industry In Canada 1984-95

	% Average compound growth rates		
	1984-89	**1989-95**	**1984-95**
Railway transport and related services	3.08	6.70	5.04
Water transport and related services	6.74	-1.01	2.44
Truck transport	1.22	-2.68	-0.92
Public passenger transport systems	n/a	n/a	n/a
Other transportation	n/a	n/a	n/a
Other transportation service	n/a	n/a	n/a
Pipeline transport	9.13	-0.31	3.87
Storage and warehousing	-0.52	2.24	0.98
Communication and other utilities	2.08	0.19	1.04
Communication	1.83	0.69	1.21
Telecommunication broadcasting	-9.05	-8.12	-8.55
Telecommunication carriers and other telecommunication	4.37	1.91	3.02
Other utilities	0.62	-1.60	-0.60
Electric power systems	0.96	-1.87	-0.60
Gas distribution systems	-1.70	-1.70	-1.70
Other utility industries	1.21	-5.19	-2.33
Trade	1.67	-7.22	-3.28
Wholesale Trade	3.27	-7.05	-2.49
Retail trade	0.29	-7.66	-4.13
Finance, insurance and real estate	-5.49	-2.96	-4.12
Deposit accepting intermediaries	n/a	n/a	n/a
Consumer and business financing	n/a	n/a	n/a
Insurance industries	-2.20	-9.21	-6.09
Commercial. business znc personal services	-1.40	-2.35	-1.92
Business services	-9.87	-7.09	-8.36
Education and related services	0.42	-2.02	-0.92
Health and social services	-0.21	-1.28	-0.79
Accommodation, food and beverage	-7.20	-2.50	-4.67
Accommodation	-7.27	-1.45	-4.14
Food and beverage	-7.02	-3.18	-4.94
Government services	-0.50	-1.85	- 1.24
Total Economy	0.98	-0.79	0.01
Total economy minus (government services and imputations)	0.87	-0.94	-0.12

Source: Centre for the Study of Living Standards based on Statistics Canada GDP and Capital Stock data, July 1997

TABLE A4:

Trends in Total Factor Productivity by Detailed Industry in Canada, 1984-95 (Using number of hours worked)

% Average compound growth rates

Industry	1984-89	.1989-95	1984-95
Agriculture	5.64	3.78	4.62
Fishing and trapping	6.36	-3.54	0.84
Logging	3.44	-3.92	-0.64
Mining, quarries, and oil wells	3.36	3.96	3.69
Manufacturing	-0.57	2.35	1.01
Food -1.84	1.89	0.17	
Beverage	0.23	2.67	1.56
Tobacco	-5.62	-1.03	-3.14
Rubber products	-2.59	10.16	4.17
Plastic products	-3.76	0.47	-1.48
Leather products	0.14	1.44	0.84
Primary textiles and textile products	-0.78	1.64	0.53
Clothing	-1.71	-4.13	-3.04
Wood	0.19	-1.83	-0.92
Furniture and fixture			
Paper and allied products	-6.69	2.09	-2.00
Printing, publishing and allied industries	-1.98	-6.03	-4.21
Primary metal industries	-0.99	4.75	2.10
Fabricated metal products	1.75	0.60	1.12
Machinery	2.14	-1.45	0.17
Transportation equipment	-4.60	1.56	-1 29
Electrical and electronic products	5.26	11.01	8.36
Non-metallic mineral products	2.23	-0.87	0.53
Refined petroleum and coal products	2.10	9.O6	5.84
Chemical and chemical products	4.51	1.93	3.10
Other manufacturing	-1.70	-0.05	-0.81
Construction	-1.12	-1.78	-1.48
Transportation and storage	1.48	0.30	0.84
Communication and other utilities	1.30	1.55	1.43
Trade - Wholesale and Retail	1.49	-3.13	-1.06
Wholesale trade	3.47	-2.51	0.16
Retail trade	0.69	-2.81	-1.24
Finance, insurance and real estate	-3.21	-2.06	-2.59

Source: Centre for the Study of Living Standards based on Statistics Canada Labour Force Survey GDP and Capital Stock data, July 1997

Labour Share of GDP based on Statistics Canada Survey of Employment Payrolls, and Hours and GDP data

TABLE A4:

Trends in Total Factor Productivity by Detailed Industry in Canada, 1984-95 (Using number of hours worked)

% Average compound growth raises

Industry	1984-89	1989-95	1984-95
Commercial, business, and personal services	-0.82	-1.44	-1.16
Business services	-4.73	-4.57	-4.64
Education and related services	-1.49	-0.85	-1.14
Health services	-0.37	-1.12	-0.78
Accommodation, food, and beverage services-	-4.31	-2.21	-3.17
Accommodation services	-4.65	0.11	-2.09
Food and beverage services	-3.99	-3.38	-3.65
Government services	-0.80	0.79	0.06
Total economy minus (govemment services and imputations)	**0.65**	**0.07**	**0.34**

Source: Centre for the Study of Living Standards based on Statistics Canada Labour Force Survey, GDP and Capital Stock data, July 1997

Labour Share of GDP based on Statistics Canada Survey of Employment. Payrolls and Hours and GDP data

Table A5: Labour Productivity, Relatives in Manufacturing, Canada & the Regions, 1995

(output per hour)

	Canada (1986$)	Atlantic	Quebec	Ontario	Manitoba	Sask.	Alberta	B.C.
					Canada= 100			
Manufacturing	25.69	72.20	88.65	111.99	75.17	69.9	119.85	89.11
Food	24.81	66.26	97.45	121.32	83.67	58.16	88.67	96.65
Beverage	42.11	n/a	78.31	121.57	128.52	33.73	116.35	97.72
Tobacco products	68.34	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rubber products	34.99	n/a	n/a	135.47	n/a	n/a	n/a	138.43
Plastic products	16.84	n/a	78.95	115.23	135.63	197.40	122.76	62.54
Leather and allied products	12.57	n/a	124.43	91.53	n/a	n/a	n/a	n/a
Primary textile and textile products	20.28	n/a	80.95	145.60	n/a	142.26	n/a	n/a
Clothing	10.54	n/a	101.18	95.26	109.64	224.07	97.50	100.37
Wood	17.23	n/a	92.37	58.43	61.69	60.91	96.21	152.91
Furniture and fixtures	14.19	n/a	80.00	135.65	57.35	32.56	94 07	55.66
Paper and allied products	31.45	n/a	116.65	84.19	87.72	n/a	146.17	103.39
Printing, publishing and allied indus	13.56	n/a	115.79	105.81	97.40	75.31	77.31	71.72
Primary metal industries	34.63	n/a	119.90	101.24	94.19	n/a	88.33	55.63
Fabricated metal products	20.73	n/a	99.20	99.25	114.98	119.49	101.32	102.11
Machinery	23.42	n/a	82.00	108.23	166.56	45.47	120.17	90.22
Transportation equipment	30.22	n/a	114.31	103.94	48.08	35.49	58.28	59.75
Electrical and electrical products	45.23	n/a	57.58	123.41	101.46	91.71	106.31	83.54
Non-metallic mineral products	24.41	n/a	90.81	97.66	67.11	28.75	209.99	105.72
Refined petroleum and coal produ	67.03	n/a	45.33	90.66	n/a	n/a	144.83	117.91
Chemical and chemical products	38.32	n/a	78.32	98.42	55.07	141.60	341.61	51.52
Other manufacturing	14.24	n/a	n/a	n/a	46.66	59.74	72.60	69.89

Sources: Centre for the Study of Living Standards Productivity Tables (http://www.csls.ca/ptables.html) - based on Statistics Canada Labour Force Survey and GDP data, July 1997.

Note: Blank space indicates data not available due to confidentiality.

Table A6: Labour Productivity, Relatives in Commercial, Business and Personal Services, Canada & the Regions, 1995

(output per hour)

	Canada (1986$)	Atlantic	Quebec	Ontario	Manitoba	Sask.	Alberta	B.C.
					Canada=100			
Commercial business and personal services	14.86	87.06	104.82	103.48	95.88	90.94	92.98	94.82
Business services	15.63	84.96	114.15	100.67	83.10	95.07	97.33	85.41
Education and related services	19.40	96.12	110.10	103.95	99.89	90.92	82.66	87.24
Health services	15.74	82.98	92.99	106.32	98.61	95.64	99.41	106.76
Accommodation, food and beverage	8.70	79.07	95.82	101.87	82.85	103.64	105.06	106.35
Amusement and recreation services	18.97	134.23	120.96	82.02	122.37	80.03	118.97	94.91
Personal, household and others	16.35	78.13	108.87	106.60	135.31	82.95	75.16	96.67

Sources: Centre for the Study of Living Standards Productivity Tables (http://www.csls.ca/ptables.html) - based on Statistics Canada Labour Force Survey and GDP data, July 1997.

Note: Blank space indicates data not available due to confidentiality.

Table A7: Labour Productivity, Relatives in Finance, Insurance, and Real Estate, Canada & the Regions, 1995

(output per hour)

	Canada (1986$)	Atlantic	Quebec	Ontario	Manitoba	Sask.	Alberta	B.C.
				Canada = 100				
FIRE minus imputations	26.82	87.32	97.29	96.12	93.20	105.48	129.62	102.66
Finance and real estate	30.45	n/a	95.78	93.34	95.40	111.05	133.45	107.15
Trust, other finance and real estate companies	36.50	86.09	109.76	89.51	98.72	118.74	131.45	98.36
Insurance	11.06	59.55	94.20	138.17	110.97	70.08	46.82	6.06

Note: FIRE in Atlantic is not minus imputations. Blank space indicates data not available due to confidentiality.

Sources: Centre for the Study of Living Standards Productivity Tables (http://www.csls.ca/ptables.html) - based on Statistics Canada Labour Force Survey and GDP data, July 1997.

Table A8: Total Economy Productivity Growth Rates by Province, 1984-95
(minus government services and imputations)

(Average annual growth rates.)

	Output per hour of Labour			Output per unit of Capital Stock			Total Factor Productivity (based on hours)		
	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95
Canada	0.48	0.93	0.72	0.87	-0.94	-0.12	0.65	0.07	0.34
Atlantic	0.10	0.59	0.37	1.77	-0.71	0.41	0.82	0.02	0.39
Newfoundland	-0.91	0.69	-0.04	2.02	-2.84	-0.66	0.33	-0.87	-0.32
Nova Scotia	-0.08	1.13	0.58	0.85	0.47	0.65	0.33	0.84	0.61
P.E.I.	2.03	0.67	1.29	0.33	-3.35	-1.69	1.07	-1.34	-0.25
New Brunswick	0.67	-0.11	0.24	2.57	-0.10	1.10	1.49	-0.10	0.62
Quebec	0.54	0.85	0.71	-0.23	-1.74	-1.05	0.19	-0.39	-0.12
Ontario	1.09	0.91	0.99	-1.23	-1.82	-1.55	0.02	-0.45	-0.24
Manitoba	0.64	0.75	0.70	0.81	-0.66	0.01	0.72	0.11	0.38
Saskatchewan	0.26	2.20	1.31	0.64	0.58	0.60	0.42	1.46	0.99
Alberta	0.08	1.14	0.65	2.50	1.55	1.98	1.11	1.31	1.22
British Columbia	-0.47	0.70	0.17	3.51	-0.74	1.17	1.19	0.11	0.60

Table A9: Manufacturing Productivity Growth Rates by Province, 1984-95

(Average annual growth rates)

	Output per hour of Labour			Output per unit of Capital Stock			Total Factor Productivity (based on hours)		
	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95
Canada	0.80	2.59	1.77	-2.15	2.09	0.14	-0.57	2.35	1.01
Atlantic	-0.12	1.43	0.72	-3.37	6.24	1.76	-1.63	3.56	1.17
Newfoundland	-1.07	3.95	1.64	-2.02	1.46	-0.13	-1.50	2.77	0.81
Nova Scotia	-1.68	1.48	0.03	-4.88	7.28	1.57	-3.18	4.00	0.68
P.E.I.	1.05	2.53	1.86	-0.95	-2.45	-1.77	0.71	0.34	0.51
New Brunswick	2.58	0.04	1.19	-1.98	7.44	3.05	0.41	3.27	1.96
Quebec	-0.56	2.48	1.09	-5.47	1.87	-1.54	-2.91	2.16	-0.18
Ontario	1.88	3.21	2.60	-1.80	2.75	0.66	0.15	2.99	1.69
Manitoba	0.77	1.03	0.91	0.03	-1.68	-0.91	0.44	-0.26	0.06
Saskatchewan	1.54	-1.88	-0.34	-16.14	-3.01	-9.22	-8.78	-2.65	-5.49
Alberta	-0.35	4.23	2.12	7.04	3.54	5.11	2.53	3.98	3.32
British Columbia	-0.21	-0.35	-0.29	-1.15	-0.76	-0.94	-1.67	-0.20	-0.87

Sources: Centre for the Study of Living Standards Productivity Tables (http://www.csls.ca/ptables.html) - based on Statistics Canada Labour Force Survey, GDP, and Capital Stock data, July 1997. Labour Share of GDP based on Statistics Canada, Survey of Employment, Payrolls and Hours, and GDP data.

Table A10: Agriculture Productivity Growth Rates by Province, 1984-95

(Average annual growth rates.)

	Output per hour of Labour			Output pet unit of Capital Stock			Total Factor Productivity (based on hours)		
	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95
Canada	3.06	2.61	2.82	8.66	5.46	6.90	5.64	3.78	4.62
Atlantic	5.58	0.98	3.05	7.79	4.88	6.19	6.65	2.70	4.48
Newfoundland	-8.13	9.17	0.94	-8.01	4.62	-1.32	-8.07	6.74	-0.27
Nova Scotia	7.40	-0.53	3.00	11.28	4.31	7.42	9.24	1.48	4.93
P.E.I.	2.25	6.24	4.41	1.08	7.28	4.42	1.66	6.77	4.42
New Brunswick	10.94	-3.64	2.73	14.05	2.84	7.79	12.43	-0.98	4.90
Quebec	8.04	-1.58	2.68	6.94	3.06	4.81	7.48	0.61	3.68
Ontario	2.87	2.91	2.89	10.25	7.54	8.76	6.17	4.66	5.34
Manitoba	-0.07	3.04	1.62	9.21	2.90	5.72	3.96	2.98	3.42
Saskatchewan	1.84	8.21	5.27	10.33	8.10	9.11	5.58	8.17	6.98
Alberta	9.50	2.93	5.86	14.95	6.59	10.31	12.02	4.43	7.81
British Columbia	9.13	4.92	6.81	14.80	6.49	10.19	11.75	5.58	8.34

Table A11: Fishing and Trapping Productivity Growth Rates by Province, 1984-95

(Average annual growth rates.)

	Output per hour of Labour			Output per unit of Capital Stock			Total Factor Productivity (based on hours)		
	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95
Canada	2.40	2.08	2.22	4.68	-3.98	-0.13	6.36	-3.54	0.84
Atlantic	-0.92	1.19	0.23	-0.51	-6.34	-3.74	-0.73	-2.83	-1.88
Newfoundland	0.93	-1.84	-0.59	-7.86	-6.50	-7.12	-3.82	-4.75	-4.33
Nova Scotia	-4.67	3.67	-0.20	1.49	-12.32	-6.29	-2.05	4.95	-3.64
P.E.I.	-1.39	-2.85	-2.19	6.06	-3.82	0.55	1.72	-3.23	-1.01
New Brunswick	4.41	-0.07	1.94	8.43	3.72	5.84	6.19	1.42	3.56
Quebec	3.58	5.08	4.39	-6.24	2.82	-1.40	-1.78	3.70	1.17
Ontario	15.26	-1.85	5.59	-1.40	10.25	4.80	5.48	4.97	5.20
Manitoba	-2.38	8.87	3.60	-13.30	-7.78	-10.33	-8.49	-3.44	-5.77
Saskatchewan	-2.07	16.56	7.69	-13.78	-16.16	-15.09	-8.70	-10.58	-9.73
Alberta	0.12	22.45	10.72	-32.89	3.99	-14.78	-24.18	6.46	-8.76
British Columbia	5.66	5.07	5.34	20.10	0.27	8.84	11.13	3.36	6.82

Sources: Centre for the Study of Living Standards Productivity Tables (http://www.csls.ca/ptables.html) - based on Statistics Canada Labour Force Survey, GDP, and Capital Stock data, July 1997. Labour Share of GDP based on Statistics Canada, Survey of Employment, Payrolls and Hours, and GDP data.
Note: Output per Hour of Labour for Alberta uses 1994 as final year. In 1995 there was no recorded employment in Fishing and trapping in Alberta.

Table A12: Logging and Forestry Productivity Growth Rates by Province, 1984-95

(Average annual growth rates.)

	Output per hour of Labour			Output per unit of Capital Stock			Total Factor Productivity (based on hours)		
	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95
Canada	3.25	-5.15	-1.42	3.78	-1.38	0.93	3.44	-3.92	-0.64
Atlantic	4.31	-4.21	-0.43	n/a	n/a	n/a	n/a	n/a	n/a
Newfoundland	0.14	-3.28	-1.74	-5.42	2.86	-0.99	-2.10	-0.96	-1.48
Nova Scotia	7.47	-5.80	0.01	0.15	1.93	1.12	4.45	-2.86	0.40
P.E.I.	3.16	7.63	5.57	n/a	n/a	n/a	n/a	n/a	n/a
New Brunswick	4.30	-3.83	-0.21	0.59	-7.38	-3.84	2.86	-5.38	-1.72
Quebec	9.67	-7.03	0.22	11.77	-8.76	0.06	10.40	-7.64	0.16
Ontario	7.85	-7.84	-1.01	0.64	-2.99	-1.35	4.86	-5.89	-1.14
Manitoba	0.69	-2.95	-1.31	-11.69	3.64	-3.63	-4.97	0.11	-2.23
Saskatchewan	-10.57	0.70	4.59	30.22	-14.95	3.22	-3.77	-1.47	-2.52
Alberta	14.47	2.06	7.52	17.27	-6.77	3.48	15.43	-1.55	5.83
British Columbia	-1.48	-4.64	-3.22	1.57	1.69	1.64	-0.44	-2.86	-1.77

Table A13: Mining, Quarries and Oil Wells Productivity Growth Rates by Province, 1984~95

(Average annual growth rates.)

	Output per hour of Labour			Output per unit of Capital Stock			Total Factor Productivity (based on hours)		
	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95
Canada	0.60	4.56	2.74	4.93	3.60	4.21	3.36	3.96	3.69
Atlantic	-3.34	2.74	-0.07	n/a	n/a	n/a	n/a	n/a	n/a
Newfoundland	-8.66	-6.56	-7.52	1.39	-12.22	-6.27	-2.71	-9.93	-6.71
Nova Scotia	-4.29	15.44	6.01	-1.19	31.82	15.63	-2.29	23.88	11.21
P.E.I.	-17.63	9.42	-3.83	n/a	n/a	n/a	n/a	n/a	n/a
New Brunswick	-0.46	7.63	3.88	9.42	17.11	13.55	5.46	12.18	9.07
Quebec	6.93	3.80	5.21	7.08	3.10	4.90	7.03	3.34	5.00
Ontario	-5.99	3.91	-0.71	-1.26	2.11	0.56	-3.00	2.78	0.11
Manitoba	-0.04	-3.62	-2.01	-2.65	-4.97	-3.92	-1.82	-4.57	-3.33
Saskatchewan	-1.09	3.40	1.33	1.26	3.43	2.44	0.43	3.42	2.05
Alberta	3.36	2.47	2.87	3.34	3.23	3.28	3.35	2.97	3.14
British Columbia	2.80	9.18	6.23	8.15	4.04	5.89	6.17	5.86	6.00

Sources: Centre for the Study of Living Standards Productivity Tables (http://www.csls.ca/ptables.html) - based on Statistics Canada Labour Force Survey, GDP, and Capital Stock data, July 1997. Labour Share of GDP based on Statistics Canada, Survey of Employment, Payrolls and Hours, and GDP data.

Table A14: Construction Productivity Growth Rates by Province, 1984-95

(Average annual growth rates.)

	Output per hour of Labour			Output per unit of Capital Stock			Total Factor Productivity (based on hours)		
	1984-89	1989-95	1984-95	19~34-89	1989-95	1984-95	1984-89	198995	1984-95
Canada	-2.31	0.18	-0.96	0.08	-3.61	-1.95	-1.12	-1.78	-1.48
Atlantic	-2.40	1.13	-0.49	-1.84	-0.12	-0.91	-2.12	0.48	-0.71
Newfoundland	-1.41	1.19	0.00	-4.63	5.64	0.84	-3.15	3.50	0.42
Nova Scotia	-1.22	0.22	-0.43	-0.87	-0.32	-2.15	-1.04	-1.64	-1.36
P.E.I.	1.97	0.36	1.09	5.04	-2.54	0.83	3.89	-0.95	1.22
New Brunswick	-5.26	2.48	-1.11	-1.76	-0.92	-1.30	-3.55	0.78	-1.21
Quebec	-2.74	0.88	-0.78	-0.72	-4.64	-2.87	-1.73	-2.09	-1.93
Ontario	-0.95	0.11	-0.37	0.38	-8.17	-4.38	-0.28	-4.64	-2.68
Manitoba	4.78	-2.18	0.93	0.49	-1.21	-0.44	2.43	-1.64	0.19
Saskatchewan	-0.42	-2.10	-1.34	-4.02	1.31	-1.15	-2.38	-0.28	-1.24
Alberta	-3.97	-2.32	-3.07	-2.46	0.99	-0.60	-3.21	-0.77	-1.89
British Columbia	-4.37	0.98	-1.49	3.25	-0.68	1.09	-0.88	0.26	-0.26

Table A15: Transportation and Storage Productivity Growth Rates by Province, 1984-95

(Average annual growth rates.)

	Output per hour of Labour			Output per unit of Capital Stock			Total Factor Productivity (based on hours)		
	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95
Canada	0.66	0.42	0.53	3.15	0.05	1.44	1.48	0.30	0.84
Atlantic	1.45	3.58	2.61	2.65	0.55	1.50	1.86	2.50	2.21
Newfoundland	-0.43	0.17	-0.10	-7.59	2.53	-2.20	-3.29	1.15	-0.89
Nova Scotia	1.33	3.58	2.55	2.58	3.77	3.22	1.75	3.64	2.78
P.E.I.	-2.84	3.62	0.63	9.17	-30.60	-14.74	0.62	-15.40	-8.46
New Brunswick	3.76	5.33	4.61	9.28	1.51	4.97	5.48	4.11	4.73
Quebec	-1.00	-0.32	-0.63	5.80	2.58	4.03	1.06	0.43	0.72
Ontario	1.39	-1.21	-0.04	1.60	-1.21	0.05	1.46	-1.21	-0.01
Manitoba	1.59	2.05	1.84	2.15	1.69	1.90	1.78	1.92	1.86
Saskatchewan	1.24	-0.93	0.05	2.61	-0.14	1.10	1.70	-0.67	0.40
Alberta	2.06	1.69	1.86	2.51	0.80	1.57	2.21	1.38	1.76
British Columbia	-0.65	1.04	0.27	3.75	-0.07	1.65	0.75	0.70	0.72

Sources: Centre for the Study of Living Standards Productivity Tables (http://www.csls.ca/ptables.html) - based on Statistics Canada Labour Force Survey, GDP, and Capital Stock data, Juty 1997. Labour Share of GDP based on Statistics Canada, Survey of Employment, Payrolls and Hours, and GDP data.

Table A16: Communication and Other Utilities Productivity Growth Rates by Province, 1984-95

(Average annual growth rates.)

	Output per hour of Labour			Output per unit of Capital Stock			Total Factor Productivity (based on hours)		
	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95	1984-89	1989-95	1984 95
Canada	0.14	3.71	2.08	2.08	0.19	1.04	1.30	1.55	1.43
Atlantic	2.59	3.58	3.12	5.91	-0.60	2.31	4.53	1.05	2.62
Newfoundland	2.00	3.78	2.96	5.68	4.44	5.00	4.14	4.15	4.14
Nova Scotia	2.24	7.60	5.13	3.20	-0.24	1.31	2.82	2.44	2.61
P.E.I.	7.68	-2.74	1.87	4.13	-1.62	0.95	5.66	-0.86	2.05
New Brunswick	3.21	-0.45	1.20	8.09	-4.94	0.77	6.02	-3.11	0.94
Quebec	0.51	4.11	2.46	2.26	-0.33	0.84	1.55	1.34	1.43
Ontario	-2.53	3.74	0.84	-0.96	-0.27	-0.58	-1.59	1.25	-0.06
Manitoba	2.49	4.97	3.84	1.38	1.73	1.57	1.81	2.87	2.39
Saskatchewan	1.13	3.68	2.52	0.37	2.10	1.31	0.66	2.69	1.76
Alberta	3.26	4.25	3.80	2.22	1.93	2.06	2.21	1.38	1.76
British Columbia	3.41	1.80	2.53	8.45	1.46	4.58	6.31	1.61	3.72

Table A17: Trade Productivity Growth Rates by Province, 1984-95

(Average annual growth rates.)

	Output per hour of Labour			Output per unit of Capital Stock			Total Factor Productivity (based on hours)		
	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95
Canada	2.28	2.00	2.13	1.67	-7.22	-3.28	2.03	-2.51	-0.47
Atlantic	1.62	0.85	1.21	-0.35	-0.93	-5.36	0.82	-4.42	-2.07
Newfoundland	0.32	0.74	0.55	1.19	-8.67	-4.29	0.67	-3.70	-1.74
Nova Scotia	2.38	1.91	2.12	-1.69	-10.72	-6.73	0.63	-5.22	-2.60
P.E.I.	1.62	1.22	1.40	-0.30	-1.90	-1.18	0.83	-0.18	0.27
New Brunswick	1.59	-0.53	0.43	0.39	-8.64	-4.64	1.10	-4.49	-1.99
Quebec	2.06	1.22	1.60	-0.56	-10.61	-6.18	0.96	-5.17	-2.43
Ontario	3.72	2.35	2.97	0.70	-6.37	-3.22	2.45	-2.13	-0.07
Manitoba	-0.24	2.40	1.19	2.01	-7.18	-3.11	0.62	-1.98	-0.81
Saskatchewan	-1.27	3.54	1.33	6.01	-3.61	0.65	1.28	0.85	1.05
Alberta	1.90	0.82	1.31	4.69	-5.46	-0.98	2.96	-1.83	0.32
British Columbia	0.24	3.08	1.78	1.80	-6.07	-2.58	0.84	-1.14	-0.24

Sources: Centre for the Study of Living Standards Productivity Tables (http://lwww.csls.ca/ptables.html) - based on Statistics Canada Labour Force Survey, GDP, and Capital Stock data, July 1997. Labour Share of GDP based on Statistics Canada, Survey of Employment, Payrolls and Hours, and GDP data

Table A18: FIRE Productivity Growth Rates by Province, 1984-95

(Average annual growth rates.)

	Output per hour of Labour			Output per unit of Capital Stock			Total Factor Productivity (based on hours)		
	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95
Canada	0.56	-0.20	0.15	-5.49	-2.96	-4.12	-3.21	-2.06	-2.59
Atlantic	-0.74	-0.62	-0.68	-5.94	-1.40	-3.49	-3.95	-1.13	-2.42
Newfoundland	0.17	0.03	0.09	-5.75	-1.13	-3.26	-3.52	-0.74	-2.01
Nova Scotia	-1.23	-0.70	-0.94	-7.94	-1.61	-4.54	-5.46	-1.31	-3.22
P.E.I.	5.35	-3.59	0.37	-4.35	-2.73	-3.47	-1.16	-3.14	-2.24
New Brunswick	-1.45	-0.38	-0.87	-3.09	-0.82	-1.85	-2.42	-0.64	-1.45
Quebec	0.29	0.13	0.20	-6.79	-3.07	-4.78	-4.18	-2.08	-3.04
Ontario	2.45	-0.83	0.65	-6.75	-4.85	-5.72	-3.49	-3.72	-3.61
Manitoba	-3.44	-0.70	-1.96	-5.75	-0.42	-2.88	-4.82	-0.53	-2.50
Saskatchewan	4.35	-2.18	-3.17	-6.69	-0.83	-3.54	-5.75	-1.37	-3.39
Alberta	-2.84	1.87	-0.30	-2.94	1.49	-0.55	-2.90	1.65	-0.44
British Columbia	2.87	0.78	1.72	-2.16	-1.62	-1.87	-0.23	-0.80	-0.54

Table A19: Commercial, Business, and Personal Services Productivity Growth Rates by Province, 1984-95

(Average annual growth rates.)

	Output per hour of Labour			Output per unit of Capital Stock			Total Factor Productivity (based on hours)		
	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95
Canada	-0.49	-0.87	-0.70	-1.40	-2.35	-1.92	-0.82	-1.44	-1.16
Atlantic	-0.92	-0.72	-0.81	-0.90	0.45	-0.17	-0.91	-0.31	-0.58
Newfoundland	-0.96	-0.66	-0.80	1.87	1.29	1.55	0.01	-0.05	-0.02
Nova Scotia	-0.78	-0.26	-0.50	-2.60	-0.85	-1.65	-1.46	-0.49	-0.93
P.E.I.	2.77	-2.22	0.02	-0.64	0.19	-0.19	0.99	-1.25	-0.24
New Brunswick	-1.77	-1.05	-1.38	-1.02	1.47	0.33	-1.50	-0.21	-0.80
Quebec	0.05	-0.50	-0.25	-0.95	-2.52	-1.81	-0.32	-1.29	-0.85
Ontario	-0.08	-1.21	-0.70	-2.79	-3.30	-3.07	-1.11	-2.07	-1.64
Manitoba	-0.31	-0.64	-0.49	-1.93	0.69	-0.51	-0.92	-0.15	-0.50
Saskatchewan	-1.47	0.01	-0.67	-3.26	0.25	-1.36	-2.14	0.10	-0.93
Alberta	-1.71	-1.41	-1.55	-0.57	0.21	-0.15	-1.31	-0.87	-1.07
British Columbia	-1.64	-0.26	-0.89	0.07	-5.17	-2.82	-1.04	-2.14	-1.64

Sources: Centre for the Study of Living Standards Productivity Tables (http://www.csls.ca/ptables.html) - based on Statistics Canada Labour Force Survey, GDP, and Capital Stock data, July 1997. Labour Share of GDP based on Statistics Canada, Survey of Employment, Payrolls and Hours, and GDP data.

Table A20: Govemment Services Productivity Growth Rates by Province, 1984-95

(Average annual growth rates.)

	Output per hour of Labour			Output per unit of Capital Stock			Total Factor Productivity (based on hours)		
	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95	1984-89	1989-95	1984-95
Canada	-0.92	1.88	0.60	-0.50	-1.85	-1.24	-0.80	0.79	0.06
Atlantic	-0.23	0.49	0.17	0.26	-0.16	-0.73	-0.10	-0.07	-0.08
Newfoundland	1.22	1.11	1.16	1.10	-0.11	0.44	1.19	0.77	0.96
Nova Scotia	-0.24	-0.52	-0.39	-0.46	-2.32	-1.48	-0.30	-1.03	-0.70
P.E.I.	0.14	-1.63	-0.83	-1.40	-3.78	-2.70	-0.58	-2.35	-1.55
New Brunswick	-1.28	1.98	0.48	1.21	-1.25	-0.14	-0.65	1.12	0.31
Quebec	-0.80	1.71	0.56	0.16	-1.61	-0.81	-0.55	0.77	0.17
Ontario	-1.35	2.49	0.73	-0.23	-3.39	-1.96	-1.06	0.73	-0.09
Manitoba	1.91	1.84	1.87	0.16	-0.82	-0.37	1.42	1.02	1.21
Saskatchewan	-0.13	1.30	0.65	-0.16	0.49	0.19	-0.13	1.07	0.52
Alberta	-1.35	4.79	1.95	-1.41	-0.15	-0.72	-1.36	3.28	1.14
British Columbia	-1.95	0.70	-0.51	-2.47	-0.32	-1.31	-2.09	0.41	-0.73

Sources: Centre for the Study of Living Standards Productivity Tables (http://www.csls.ca/ptables.html) - based on Statistics Canada Labour Force Survey, GDP, and Capital Stock data, July 1997. Labour Share of GDP based on Statistics Canada,

Survey of Employment, Payrolls and Hours, and GDP data.

Table 21: Trends in Aggregate Real Income Measures in Canada, 1947-96
(average annual rate of change)

	1947-73	1973-81	1981-89	1989-96
Per capita GDP	2.6	2.5	2.0	-0.0
Per capita personal income	3.1	3.0	1.5	-0.8
Per capita disposable personal income	2.7	2.9	1.1	-1.3

Source: National Accounts data from Statistics Canada

Table 22: Trends in Real Output, Employment, and Output Per Worker in Canada, 1947-96
(average annual rate of change)

	1947-73	1973-81	1981-89	1989-96
Real GDP	5.0	3.8	3.2	1.2
Employment	2.3	2.9	1.7	0.6
Output Per Worker	2.7	0.9	1.5	0.6

Source: National Accounts and Labour Force Survey, Statistics Canada